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ALASKA

VOLUME II

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HARRIMAN ALASKA EXPEDITION
WITH COOPERATION OF WASHINGTON ACADEMY OF SCIENCES

ALASKA

VOLUME II

HISTORY, GEOGRAPHY, RESOURCES

BY WILLIAM H. DALL, CHARLES KEELER
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THE DISCOVERY AND EXPLORATION OF ALASKA

BY WILLIAM HEALEY DALL

THE history of Alaska is practically the history of exploration and trade along its coasts and within its borders. It may be conveniently divided into characteristic periods. First comes the era of discovery and exploration by independent parties of Cossacks, hunters, and fur-traders, whose reports led to the dispatch of the official expeditions commanded by Bering, whose discoveries, in turn, opened the floodgates for a tide of adventurers. This period may be said to comprise the whole of the eighteenth century up to June, 1799. The second period began with the chartering of an imperial monopoly, the Russian-American Company, to which was confided in that year the control and exploitation of the Russian possessions in America. The characteristic figure in the panorama of the events of this era is Baranoff.

In 1867 a third period began with the American occupation of the territory; followed by the lease of the seal islands to the Alaska Commercial Company, and by the exploitation of the fisheries. A condition of anarchy prevailed over the greater part of the Territory, due to legislative neglect and executive indifference. With the opening of the Klondike gold fields in 1895, a fourth era began, into which the country has barely entered, and the outcome of which it is yet too soon to predict. So far it has been characterized by renewed exploration; by the grant from

Congress of some tardy and far from adequate legislation looking toward good order and settlement; by the exhaustion of the fur trade; and by the development of mineral resources in the line of the precious metals.

The geographer Gerhard Friedrich Muller during his researches in Siberia about 1750, ransacked the archives of Yakutsk and other East Siberian settlements for records of early explorations. His extracts from them are all that are saved to us of those invaluable reports, the originals of which were long since destroyed by the fires which have repeatedly ravaged the cities of eastern Siberia. Among these extracts is found one relating to the journey of Peter Iliunsen Popoff who was sent to East Cape in January, 1711, with two interpreters, to endeavor to induce the obstinate Chukchi natives to pay tribute, and to obtain such information about the region as could be secured. The party returned to the trading post on the Anadyr River in the following September. They had not been able to convince the Chukchi that there was any sufficient reason for paying tribute, but they brought back, among other items of information, the news that beyond the islands off the Chukchi peninsula lay a large continent, forested, inhabited, with great rivers, where were a people with tails like dogs, wearing skin clothing, and living upon wild reindeer and sea animals. The learned academician apologizes for recording this fable of the wild Chukchi, which, however, carries with it the confirmation of the story of Popoff's visit; since we now know that it is a common practice of the American Eskimo to wear the tail of a wolf or dog at the back of his girdle on ceremonial occasions, or while traveling.

This is the first authentic mention of the continent east of Bering Strait and its inhabitants, though mention had been made by earlier explorers of accounts by the Chukchi of the Diomede and St. Lawrence Islands.

MENDING HIS CANOE

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SITKA INDIAN HUTS

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The exploration and gradual conquest and settlement of eastern Siberia was the work of a multitude of adventurers, known generically as Promishleniki or hunters. They included the more turbulent and enterprising of the border population of Siberia, such skirmishers of half savage, wholly unmoral, humanity as most nations drive before them, in an advance into the wilderness. Powerful from the arms which they borrowed from civilization, desperately energetic, they defied cold, starvation, war, the perils of the sea, and the unknown terrors of the wilderness, in their love of adventure and greed of gain. Penetrating a region like a creeping conflagration, consuming and destroying, yet they leave it cleared, after a fashion, for the advent of a real civilization. In Asia nothing but the sordid poverty of the Chukchi could hold its own against them.

Rumors of their discoveries gradually filtered through the wastes of Siberia to Russia. An expedition was fitted out to ascertain the facts and especially whether America and Asia were really separated. Vitus Bering, a Danish officer naturalized in Russia, was assigned to the command, with Alexis Chirikoff as his chief assistant. July 20, 1728, the expedition left Kamchatka for the north, sailed through Bering Strait without seeing the Diomedes or the American shore, and presently returned to Kamchatka. The next year in June he sailed eastward from Kamchatka some sixty miles in vain search of the American continent, and then made his way back to Okhotsk. A second expedition was projected in 1732, and under the same commander sailed from Kamchatka June 4, 1741, to find the American coast. On July 18th, Bering anchored under the lee of Wingham Island near the mouth of the Copper River and thence made his way westward along the line of the Aleutian chain to be finally wrecked on the island which now bears his name, where he died of

scurvy December 8, 1741. The survivors reached Kamchatka on the 27th of August, 1742.

The immediate result of the arrival of the survivors of the expedition with their wonderful tales of the abundance of fur animals and the near proximity of a great archipelago, was to stimulate every inhabitant of the region who could leave Kamchatka, to push out and secure riches.

As iron and most necessaries for shipbuilding had to cross Siberia, and were correspondingly dear, the Promishleniki made themselves boats of planks sewed together with rawhide thongs and caulked with moss and oil. Cattle were few and precious, salt meat hardly to be had. The traders stocked up with salmon and in their crazy boats pushed boldly out to sea. On reaching Bering Island they went ashore and hunted the sea-cow (Steller's manatee) and salted down its beef-like flesh. When fully supplied they pushed on to the Aleutian Islands.

There had long been traditions among the Kamchatkans of islands off the Aliutorsk Cape; referring probably to St. Lawrence and the Diomedes. These were known colloquially as the Aliutorski Islands. When Bering discovered the archipelago it was concluded that these were the islands of the tradition, and so the name of a Kamchatkan cape became fixed upon a region and people in no other way connected with it.

The Sibiriaks did not trouble themselves to buy furs from the natives. Their firearms, though few and archaic, were an argument which proved conclusive in any controversy with a people armed only with bone-headed hand-lances. On arriving at a native settlement the people were corralled, their furs, if any, taken as 'tribute,' the young girls captured as 'hostages,' and the old people sent out to hunt, bring driftwood, or catch fish for the invaders. Resistance was useless, though frequently attempted, and was punished by massacres which thoroughly

HUT ON WOOD ISLAND

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terrorized the survivors. Within the memory of living men, the Aleutian mother quieted her fretful child by calling on Glottoff and Drusenin, who were of those who reigned in this hell they had created. As one island after another was depleted of its furs, succeeding parties pushed further and further eastward.

In 1763 parties reached Kadiak and the peninsula of Alaska. Here a more vigorous and courageous people, true Eskimo, replace the Aleuts. Accustomed to meet and conquer the mighty bears of the island, these people resisted enslavement and slew many of their persecutors. Moreover many of the Aleuts arose in desperation, happy if in dying they could carry with them even one of their tyrants. Many committed suicide; the population was becoming scanty; the bands of Sibiriaks, too numerous to be easily fed from the resources of the country, or to be satisfied with the diminishing store of skins, turned their arms sometimes upon each other. About this time the government began to send out officers to survey the new possessions and incidentally to establish order and secure the imperial tribute. Among others Krenitzin and Levasheff, two naval captains, after whom Captains Bay, Unalaska, is named, wintered there in 1768. They made the first charts of the archipelago and returned to Okhotsk in 1769.

Somewhat checked by the presence of officials and the other difficulties of the situation, the fur-traders began to combine in companies and to systematize the business. Several corporations were formed which soon began to clash with each other. Still, the climax of the saturnalia had passed and the half-insane orgies of the first years were no longer repeated.

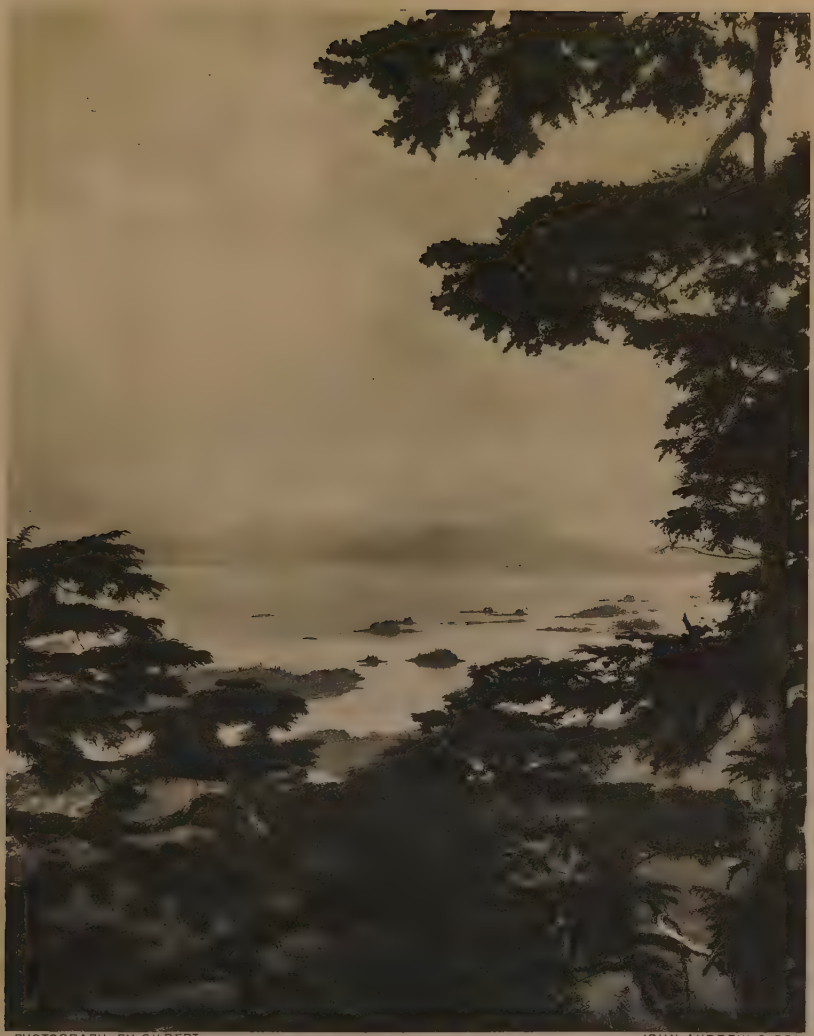
The cream of the fur trade had been skimmed, the Aleut nation diminished to a tenth of its original number. They were necessary to hunt the otter; it became no longer profitable to waste the male population.

Meanwhile other nations had become dimly aware of an unoccupied empire, rich in furs and affording a market for trade, on the northeast border of the Great Ocean.

Spain, through her representatives in Mexico, made the first move, and Ensign Juan Perez reached the latitude of Dixon Entrance in 1774. The following year Bodega and Maurelle attained to the vicinity of Sitka Sound, where they saw and named Mount San Jacinto, now known as Edgecombe. In 1776 the immortal James Cook sailed from Plymouth, England, for a voyage of discovery in the North Pacific. On the roster of his officers we read the well-known names of Clerke, King, Bligh (later of the Bounty), Burney, Gore (of Virginia), John Ledyard (of Connecticut), and Vancouver (as midshipman). During the spring of 1778 Cook traced the northwest American coast from Nootka to Icy Cape and then turned back to meet his fate among the islands of Hawaii. Some additions to the work were made the following year by Clerke and Gore, while the Spanish vessels under Arteaga and Bodega pushed their researches as far as Prince William Sound.

We owe to Cook the first generally accurate delineation and positions of the Northwest coast as a whole, and it is surprising how near he came to the best modern results obtained with far superior instruments. Those who followed him, for many years, added and elucidated chiefly in details.

In 1781 Shelikoff, Golikoff, and other merchants of Siberia formed a corporation for the more effective management of their business, and dispatched vessels to the Northwest coast. The French naval captain La Perouse with a shipful of young noblemen, who apparently disdained to trouble themselves with navigation or seamanship, touched in 1786 on the northwest coast near the Fairweather ground, surveyed Lituya Bay and lost two



PHOTOGRAPH BY GILBERT JOHN ANDREW & SON

MT. EDGECUMBE FROM BACK OF SITKA

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boats and twenty-one men who carelessly ventured into the bore at the narrow entrance. About this time independent fur traders began to visit the coast. James Hanna of Macao traded at Nootka in 1785, and in a few years numbers of ships appeared from various quarters of the globe. Some of these men had a liberal education and made their voyages contribute to geographical and natural science as well as pecuniary profit. Among the better known were Meares, Portlock, Dixon, Berkeley, and Cox, all Englishmen; Ingraham, Gray, Sturgis, Kendrick, and Cleveland from New England.

The Spanish authorities claimed the sole right to navigate the waters of the Northwest coast though they had never utilized any of its resources. To drive away the 'Boston' and 'King George' men, as the Yankees and Englishmen were called in the trade jargon, they sent, in 1788, some armed vessels, under Martinez and Haro, on a voyage of reconnaissance. These extended their investigations as far as Kadiak and Unalaska before returning to California. The following May the same officers proceeded to Nootka where they took possession in the name of Spain, built a small fort, and seized three British vessels under Colnett and Hudson which had been sent from Macao by Meares. The American vessels were not molested, and Gray, in the Columbia, after various explorations sailed for Canton, where he exchanged his furs for tea, with which he reached Boston, August 10, 1790, having carried the United States flag around the world for the first time.

The action of the Spaniards in seizing the British vessels did more for the exploration of the coast than all their surveying expeditions. The British government protested against the proceeding and, with the acquiescence of Spain, George Vancouver was sent to the Northwest coast to determine with the aid of a Spanish Commissioner what

indemnity was due the parties. He was also instructed to survey the coast from the 35th to the 60th parallel of north latitude so as to set at rest finally the theories which claimed, somewhere in this region, the existence of a 'northeast passage'— a waterway leading eastward to Hudson Bay. On his way north he missed the mouth of the Columbia River, of whose existence he was later informed by Gray. This omission may have served to put him on his mettle; at all events the surveys which he conducted during 1792–4, were worthy of the best explorer of his time. No other man has given to the world a detailed survey of equal excellence of so many miles of intricate coast, and under analogous conditions. Vancouver died, worn out by his exposure and heroic exertions, just as his report was coming from the press. His last days were saddened by the insults of a ruffian of the nobility, Lord Camelford, who had been discharged from the expedition for bad conduct before the Pacific was reached. The only memorial in England dedicated to Vancouver is a tablet erected by the Hudson Bay Company in the little parish church of Ham, near Richmond, where he lies buried.

During these years Shelikoff and Baranoff had received from the empire exclusive trading privileges in the Russian possessions. Several Russian expeditions had visited the coast under Sarycheff, Billings, and Hall. By 1794 the cries of the unfortunate Aleut reached even to St. Petersburg and the Emperor Paul contemplated withdrawing the corporate franchises which had been so fearfully abused. Some Russian missionaries had been sent out, but the natives, except when terrorized, did not receive them very cordially, naturally fearing 'the Greeks bearing gifts.'

In 1799 the Emperor Paul granted a charter for the term of twenty years to a new company which was to

PHOTOGRAPH BY CURTIS

INTERIOR OF THE GREEK CHURCH AT SITKA

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enjoy exclusive rights. Under the name of the Russian-American Company the new organization was required to organize settlements, promote agriculture, commerce, discovery, and the propagation of the Greek Catholic faith, and to extend Russian influence and territory on the Pacific so far as it might be done without trespassing on the territory of any foreign power. The government of the colonies was confided to the Chief Director, who resided at Kadiak. No appeal could be made from him except to the Directory at Irkutsk which settled all regulations and appointments and decided all questions which might be raised, subject to the approval of the Imperial Department of Commerce. Outside of Kadiak other dis-

THE FIRST RULER OF RUSSIAN AMERICA.

Alexander Andreivich Baranoff, administrator of the Russian colonies in America, 1792–1817; died at Batavia, April 28, 1819.

tricts were ruled by inferior agents chosen from among the employes and accountable only to the Chief Director.

The general regulations were just and humane, but the enforcement of them was entrusted to men with whom justice was always subservient to expediency. Baranoff maintained for twenty years an absolute and despotic sway over the colonies. The orders of the Directory were often unheeded by him and it was almost as easy for complaints to reach the Directory from another planet as from Russian America. He was a man of iron energy and nerve, coarse, unfeeling, shrewd, and enterprising. Among his subordinates were men far more intelligent and humane than himself, but any improvements were proposed in vain if in his judgment they conflicted with the interests of the company. Krusenstern, one of the Russian naval officers, remarks of the servants of the Company, "none but vagabonds and adventurers ever entered the Company's service as traders; it was their invariable destiny to pass a life of wretchedness in America; and few had the good fortune to touch Russian soil again." Naturally most of the personnel of the service in the colonies was drawn from the ranks of those who had served in the Shelikoff and other companies, and it is doubtful if the change of masters made any perceptible difference to the Aleuts or other natives under the control of the Russians. However, more business-like methods were introduced in the general conduct of affairs; among the new officers of the Company were some men of intelligence, refinement, and kindly nature, as well as of scientific acquirements. Though the Aleuts were treated as serfs of the Company they were entitled to a certain amount of subsistence, and the absence of competition took away many of the previous grounds for friction.

The official interest in the Company grew as explorations by Russian naval officers increased. In 1800 the chief officers were moved from Irkutsk to St. Petersburg. Two years later the Emperor, Empress, and Grand Duke

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JUNEAU, ALASKA

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Constantine became shareholders in the corporation, and the Loan Bank of St. Petersburg was directed to loan 250,000 silver rubles to the Company at eight percent. As the operations of the Company became more widespread, their vessels commanded by Russian naval officers constantly explored new portions of the coast. The trading post established at Old Harbor, Sitka Sound, by Baranoff in 1799 did a good business, and in the spring of 1800 Baranoff formally took possession in the name of Russia of the region now comprised in southeastern Alaska. In contrast with the relatively mild native of Eskimo stock with whom the Russian had dealt to the westward, the pugnacious and turbulent Tlinkit of the Sitkan Archipelago kept the settlers and traders constantly on the defensive. In May, 1802, the Sitkan natives attacked the Russian post and massacred the entire party excepting a few who took to the woods and were rescued by Barbour, the master of a British trader. Attacks were also made on Russian hunting parties in various parts of the Archipelago. During the same year the Stikine River was discovered by the American ship Atahualpa of Boston.

An expedition under Krusenstern and Lisianski in the ships Nadeshda and Neva sailed for the colonies in August, 1803. The colonial officials pushed their explorations some distance up the Copper River and sent hunting and trading parties to Oregon and California.

In 1804 Lisianski in the Neva joined Baranoff before Sitka, where the native stronghold was defended energetically against the Russian cannon. It was evacuated by the Tlinkit when their ammunition was exhausted and the Russians immediately laid the foundation of a fortified post on the very defensible peninsula which had been occupied by the natives. As the Archangel Gabriel, to whom the post at Old Harbor had been dedicated, had not protected it against the heathen, the new post was de-

voted to the Archangel Michael in hope of better results, whence it was commonly called New Archangel, a name which has now given place to Sitka, from the native designation of the bay upon which it is situated.

For some years the progress of discovery and trade was slow, though not unimportant. In 1816–1817 Kotzebue was engaged in the work of exploration in the Aleutians and northward. In August, 1816, he entered the Arctic Ocean and explored the sound which bears his name. In 1818 the eastern shores of Bering Sea, especially Bristol Bay, were explored by Korsakoff and Kolmakoff. In 1819 an expedition for geographical discovery was fitted out at St. Petersburg under Vasilieff and Bellingshausen. Baranoff, returning to Russia, died at Batavia April 28th, being about eighty years old, and leaving, in spite of his active career and exceptional opportunities, no fortune. His death made practicable the more exact fixing of responsibility for colonial matters, and numerous much needed reforms were carried out in the subsequent administration of the Company's business.

At this time the Russians had settlements or fortified trading posts in California, Sitka Sound, Prince William Sound, Cook Inlet, Kadiak, five of the Aleutian Islands, the Pribilof Islands, and Nushagak in Bristol Bay.

A convention between Russia and the United States relative to boundaries, privileges for hunting and fishing, and regulations governing trade, was signed at St. Petersburg April 17, 1824. A less conspicuous event which had for a large part of the Territory even more important consequences was the arrival in the Colonies of Father Innokenti Veniaminoff, who had been sent as a missionary priest to Unalaska. It is one of the mysteries of the human mind how a religion brought by men guilty of every infamy could be accepted by their victims; and it is probable that the reasoning, if any, indulged in by

PARK-LIKE SHORES NEAR KADIAK

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conforming Aleuts was that a religion and a God which could save from eternal torment such men as Glottoff and Solovioff, must be remarkably efficacious and powerful.

THE APOSTLE TO THE ALEUTS.

Ivan Veniaminoff, in religion Innokenti, born September 1, 1797, missionary to the Aleuts 1823–33, to the Tlinkit 1834–40, Bishop of Kamchatka 1841–67, Metropolitan of Moscow 1867–79, died April 22, 1879.

However this may be, in Veniaminoff came a man who dealt justly and loved mercy; a man filled with the radiant spirit of a savior of men. He made himself one with his people, loving and beloved. Nor did he rest satisfied with spiritual ministrations. He learned their language, studied with affectionate comprehension their manners and customs, recorded the climatic and physical conditions under which they lived, and in his 'Notes on

the Unalaska District' has built the only existing foundation for the anthropology of the people he served so well. For seven years he worked among them and his memory is still dear in the land.

In 1825 a convention between Great Britain and Russia was signed, by which the boundaries of Russian territory were established, the Hudson Bay Company definitely excluded from every part of the seacoast north of Lat. 54° 40′, and the unknown territory north of the St. Elias Alps equitably divided by an astronomical line, the 141st meridian west from Greenwich.

The interest in Arctic exploration which had been instrumental in promoting the voyages of Ross, Franklin, Parry, Richardson, and Back on the northeastern shores of America now instigated cooperative explorations in the North Pacific. This work began with the work of Beechey in H. M. S. Blossom, which sailed from England in 1825. The following year one of the most fruitful of Russian scientific expeditions to America sailed from St. Petersburg in the corvette Seniavine, commanded by Lütke, who was assisted by the naturalists Kittlitz, Postels, and Mertens. Beechey pushed northward as far as the ice would admit his vessel and sent a boat party, under Elson, which reached and named Point Barrow, the most northern extreme of Alaska. During the same summer Franklin, pushing westward from the Mackenzie, reached Return Reef, the most western point of his explorations, on the Arctic coast.

The Company's officers continued their surveys in 1832, established Fort Kolmakoff on the Kuskokwim River, and a year later Tebenkoff built Redoubt St. Michael on Norton Sound. In 1835 a meteorological and magnetic observatory was established at Sitka, where for many years a first class series of observations was kept up. In 1835 the delta of the Yukon and Kuskokwim was explored

PHOTO. BY CURTIS

ELSON-BOSTON

DUTCH HARBOR, UNALASKA

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by Glasunoff, and the Yukon was ascended as far as Anvik. In 1837 Dease and Simpson of the Hudson Bay Company completed the survey of the Arctic coast between Franklin's Return Reef and Point Barrow; and Sir Edward Belcher in H.M.S. Sulphur made various explorations between Sitka and Kadiak. In 1838 the trading post at Nulato was established on the Yukon by Malakoff. Evacuated during the winter, it was burned by the natives, but reestablished in 1841 by Derabin who remained in command. In the course of 1842–1843, the Yukon as far up as Nowikakat was examined and mapped by Zagoskin. In 1847 McMurray of the Hudson Bay Company coming from the Mackenzie, descended the Porcupine River and built Fort Yukon near its junction with the Yukon River.

In 1848 the Franklin search expeditions were sent out, inaugurating the most active period of exploration of the polar regions. The Herald and Plover were sent to Bering Strait to cooperate with parties working from the eastward. During this summer the first American whaler to venture through Bering Strait, the ship Superior, Captain Roys, was rewarded by a successful catch in a very short time. The report of his success spreading, he was followed in 1849 by a fleet of one hundred and fifty-four American whalers, and the fishery was thus permanently established north of the Strait.

During the summer of 1849 the Herald and Plover, assisted by the private yacht Nancy Dawson, explored the Polar Sea north of Bering Strait, landed on Herald Island and probably had a glimpse of Wrangell Land. A boat expedition under Robert Pullen reached the Mackenzie River from Point Barrow, ascended to Fort Macpherson and returned home by way of York Factory and Hudson Bay, one of the most remarkable journeys on record for this region. In 1850 the Franklin search was energetically

continued by McClure and Collinson who sent Lieutenant Barnard up the Yukon to Nulato in search of information, while Bedford Pim explored between Norton and Kot-

POLAR EXPLORER AND RUSSIAN GOVERNOR.

Admiral Baron Ferdinand Petrovich von Wrangell, reformer and administrator of the Russian American colonies, 1829–1836. Born December 29, 1794. Died May 25, 1870.

zebue Sounds and Grantley Harbor. Barnard perished in an attack on Nulato by the Koyukun Indians. During the next four years Arctic exploration and the search for Franklin were carried on by the officers above mentioned, and by Kellett, Maguire, and Trollope.

In 1854 the Ringgold and Rodgers exploring expedition made valuable surveys in the Aleutian Islands and the vicinity of Bering Strait. In 1860–1861 Robert Kennicott, of the Smithsonian Institution, coming from Hudson Bay by way of Fort Yukon, descended the Yukon to the

PHOT. BY CURTIS

ELSON-BOSTON

FORT WRANGELL

PHOTO. BY CURTIS

ELSON-BOSTON

SITKA HARBOR

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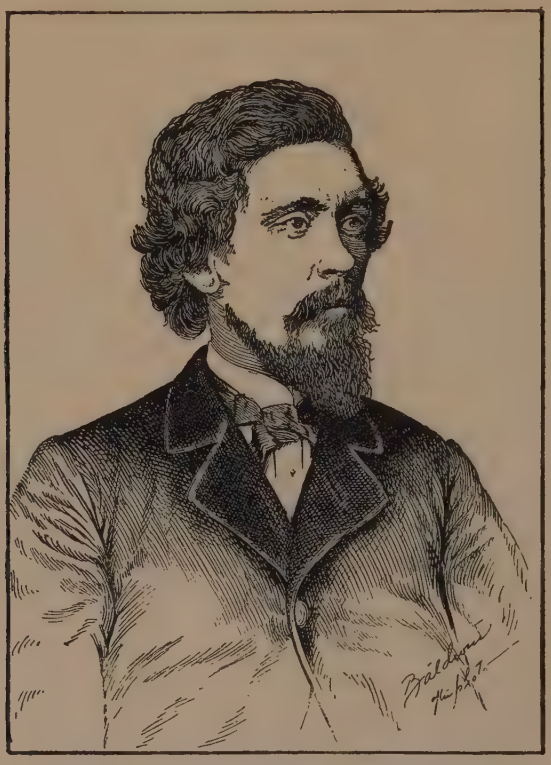
Small Houses. In 1863 Strachan Jones, commanding at Fort Yukon, descended the Yukon to Nowikakat. This point had been reached by Zagoskin, ten years earlier, from the sea; but neither the Russians nor the Hudson Bay men appear to have been aware of the work of the rival party. Hearing now of the presence of the English, the Russian commander at Nulato sent Ivan Lukeen, a half breed, with a party of Indians, up the river to gather information. This party reached Fort Yukon where they traded and returned to St. Michael.

The successive failures of several Atlantic cables to work for any length of time, had disposed many telegraph men to believe that no permanently working cable of that length could be expected. This led to a plan for an international telegraph overland from the mouth of the Amur River in Siberia to Bering Strait, crossing by a short cable, and thence again overland up the valley of the Yukon and through British Columbia to civilization. The cooperation of the Russian government was secured and the command of an expedition to make the necessary explorations was entrusted by the Western Union Telegraph Company to Capt. Charles S. Bulkley. This expedition was organized in San Francisco in 1865, and included a number of scientific men under Robert Kennicott, selected through the good offices of the Smithsonian Institution.

Through their explorations it was first made known to the world that the Yukon of the English and the Kwikpak of the Russian maps were one and the same great river, which was first mapped with approximate accuracy from their rough surveys.

Kennicott died during the spring of 1866, but Frank Ketchum and Michael Lebarge carried out his plans and ascended the Yukon to Fort Yukon. Kennicott was succeeded in charge of the scientific corps of the expedition by William H. Dall, who with Frederick Whymper in 1867

ascended and mapped the Yukon to Fort Yukon and the boundary, while Ketchum pushed on in birch canoes to the site of old Fort Selkirk, both returning together to the sea.



FIRST AMERICAN EXPLORER OF THE YUKON.

Robert Kennicott, naturalist, born November 13, 1835, died at Nulato, on the Yukon River, May 13, 1866.

Space fails to enumerate the details of the surveying and scientific research which were carried on by this expedition or resulted indirectly from its work,[1] but there is little doubt that the acquisition of Alaska by the United States was largely due to the information brought back by the telegraph explorers.

[1] An account and bibliography of this subject is to be found in the Bulletin of the Philosophical Society of Washington, XIII., pp. 123–162, December, 1895.

PHOTOGRAPH BY CURTIS

INDIAN RIVER, NEAR SITKA

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In 1867, the Western Union Telegraph Company, finding the Atlantic Cable at last a success, withdrew its parties from Alaska. About the time many of the members of the expedition had returned to the eastern United States the question of the purchase of the Territory was being discussed, and the favorable decision finally arrived at was, with little doubt, largely due to the information at first hand these gentlemen furnished to those considering the subject.

On the 18th of October, 1867, the Russian authorities formally surrendered the Territory to General L. H. Rousseau, U. S. A., acting for the United States at Sitka. Previous to this time, since the expiration of the charter of the Russian-American Company in 1862, its business had been carried on under the general supervision of an Imperial governor. That the charter was not renewed was directly due to the exposure of abuses which existed in the management and had been more or less characteristic of the conditions in the Territory since the beginning of the century. Nor was the transfer to the custody of the Republic to work an immediate cure. A history of conditions in Alaska from 1867 to 1897 is yet to be written, and when written few Americans will be able to read it without indignation. A country of which it could be said with little exaggeration that

> "Never a law of God nor man
> Runs north of fifty-five."

A country where no man could make a legal will, own a homestead or transfer it, or so much as cut wood for his fire without defying a Congressional prohibition; where polygamy and slavery and the lynching of witches prevailed, with no legal authority to stay or punish criminals; such in great part has Alaska been for thirty years. The waning of the fur trade and the increase in population due

to the discovery of gold have forced attention to the needs of the region, and the future is not, as the past seemed to be, without hope for better government. It will be a perpetual testimony to the character of the early American settlers in Alaska, that under the circumstances in which they found themselves they bore themselves so well.

It would require a row of stately volumes to contain an adequate account of the explorations and surveys made since the transfer by the Coast Survey, the Geological Survey, and officers of the Navy, the Revenue Marine, and the Army. The amount done is marvelous, yet hardly known to the public. To one conversant with the facts, one of the most amusing things in current literature is the placid innocence of many a casual traveler or gold hunter, who pours out his tale of experiences in the confident belief that nothing of the kind is on record. A bibliography, far from complete, yet with fully 4,000 titles, does not cover the publications in books and serials upon the Territory and its adjacent regions.

It is true that of satisfactory and reliable books on the general subject there is an obvious dearth. This, however, cannot long be the case. That all the virgin territory has been reached is far from true, and there still remains a good opportunity in many parts of Alaska for the work of the careful and energetic anthropologist or geographer.

The work of the Harriman Expedition, in spite of the extremely limited time available at any one locality, shows how large a field there is as yet untilled. While the sublime scenery of the southern coast will long be the goal of tourists, we may confidently anticipate for years to come a rich harvest for the scientific explorers and naturalists whose good fortune may lead them to the fascinating study of the virgin North.

PAINTING BY L. A. FUERTES.

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KADIAK PINE GROSBEAK, PINICOLA ENUCLEATOR FLAMMULA

Kadiak, July 1899. Male

DAYS AMONG ALASKA BIRDS

BY CHARLES KEELER

HERE was to me a peculiar interest in the birds seen during our memorable voyage along the Alaska coast, in that most of them were old friends, known through many a California winter. I was now to be taken into the privacy of their homes and to make their acquaintance at the brief period when all the best and sweetest scenes of their lives are enacted. Many of them are silent, for the most part, during their winter visits, and only on the Alaska shores are their songs to be heard. Others, which sing about my garden in midwinter, were uttering the same familiar strains in this region of enchanting grandeur. There were also strangers of rare interest among them—inhabitants of Arctic tundras and the storm-swept rocks of Bering Sea.

During the early days of the voyage the ornithologists of the party were sadly disappointed on account of the scarcity of bird life. We sailed by mile upon mile of forest land with inviting shore lines, where streams of water tumbled and roared down the mountain sides, but upon landing the forest presented a harsh and inhospitable barrier of devil's club, swampy thickets, and great fallen tree trunks overgrown with rank vegetation. On forcing

our way into these forest retreats we found but little indication of the presence of animal life. Silence reigned, broken now and then by the squeak of a Harris's woodpecker or the short fine note of the pileolated warbler. This frail, beautiful little creature with its fine golden plumage and black cap, its dainty manners and sprightly song, was one of the few birds found in considerable numbers in the forests of the southern portions of the inland passages.

The northwest crows and the ravens forced themselves upon our attention from the outset. We are accustomed to think of ravens as shy birds, dwelling in remote and desolate places, upon the wastes of the plains, or on dreary rock-bound sea coasts, but at every village in Alaska they are as abundant and tame as chickens in a farmyard. It is not strange that the raven has been a bird held in superstitious reverence or fear among men of many races and in various parts of the world — that it has been a theme for poets and a study for scientists as well as a sacred being among the Tlinkit Indians. In appearance it is wiser than an owl. It is more full of strange antics than a parrot and quite as talkative in its own peculiar vernacular.

It is well that it is held in veneration by the Indians and in contempt by the whites, for the untidy habits of the people make these scavengers quite indispensable. There is something inexpressibly droll and quaint about the sidling hops and curious prancing walk of these big, lustrous black fellows, with their sharp eyes and strong, black beaks ; they turn their heads on one side in such a knowing fashion when they look at any strange object, and their cries are so expressive of their varied emotions. Their typical call is a deep, guttural, rattling croak, not wholly unmusical, although loud and wild. I wrote down some of the calls they uttered, indicating as well as possible in letters the

PYROLAS

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effect of their tones. *Quāāk! quāāk!* an old fellow would call from the top of a Sitka spruce, and then suddenly change to a low, deep-voiced *wŏŏp!* — rolling it out like an Indian war whoop. Again he would vary the note to a milder *yup-quōōk!* with a persuasive, liquid quality in his voice.

They spend much time on the beaches where refuse is plenty, and seem to lead happy, independent lives there, with little to worry them and much to make merry over. The raven is about two feet long and may be distinguished from the crow not only by its much greater size, but also by the distinct and pointed effect of the feathers of the throat. Altogether I have found them among the most entertaining and intelligent birds I have had the good fortune to know.

Another conspicuous and widely distributed bird, that we encountered almost at the outset of our voyage and which was ever a part of the landscape until we entered Bering Sea, is the bald eagle. The adult, perched in the top of a spruce or hemlock, its white head contrasting with the black of its body, makes a striking picture and seems peculiarly in keeping with the grandeur of the scenery and the solitude of these wave-washed shores.

If the eagle seems to belong to these solitudes of the Northwest, another bird, which we found equally abundant as far north as Juneau and Sitka, seemed singularly out of place. Indeed, even after reading that the tiny rufous hummingbird journeyed so far into the northern wilds, it was with almost a shock of surprise that we saw the dainty creature, which we instinctively associate with the tropics, contentedly buzzing about the salmon berries and appearing as unconcerned and happy as if his fine wings had not carried him some thousands of miles from his winter quarters in southern California or Mexico. I cannot imagine a more wonderful instance of bird migration

than this — one of the smallest known birds, no larger than a fair sized moth, yet with strength, endurance, and intelligence to travel up and down the greater part of the North American coast line, pressing close upon the train of early spring, awaiting only the blooming of the wild currant in California and the salmon berry farther north, to venture upon his perilous way! His whole make-up is of fire. It shows upon his burnished helmet and gorget, and flashes with every turn of his alert head; it appears in the warm rufous of his back and sides, and more than all else in the daring spirit that can achieve such wonders! All hail to thee, little pioneer! You explored the wilderness centuries before the birth of Bering, Cook, or Vancouver; you answered the beckoning blossoms and followed them into whatever forest halls they summoned you, even upon the very threshold of the ice king's domain! May the two white dots of eggs in thy felted cradle reward thy toil, and may thy whole family of intrepid nomads escape the dangers of their southward journey!

Steller's jay is one of the characteristic birds of the forested coast regions of the Northwest. It is noisy and showy, constantly obtruding its presence wherever the traveler may tarry, although its marked preference for the vicinity of man was frequently noted. It is a big crested jay with sooty black head and back, deep blue-black barred wings and tail, and a paler blue breast. He is a rollicking fellow with a loud voice, saucy manners, and eminently social habits.

During our short stay at Wrangell we found birds more numerous than at any point previously visited. Species that had enlivened the forest-covered shores wherever we had landed were here in abundance, and in addition there were many well-known friends we had been accustomed to associate with more southern latitudes. Barn swallows

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RUFOUS HUMMINGBIRD, SELASPHORUS RUFUS

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flitted about with light agile turns and fine chattering cries, quite as much at home in this historic Alaska hamlet as they are in the farmyards of Massachusetts and the ranches of California. A few white-breasted swallows sported over the house tops, and the demure little Lincoln's finch was at home in the shrubbery. He is a first cousin to the song sparrow — a commonplace appearing bird, brown and gray in color with profuse streakings above and below. He may be distinguished from his nearest relatives by the buff ground color of the breast, that of the song sparrows being white. Here also we caught our first glimpse of the dwarf hermit thrush, and heard the first far-away strains of his entrancing song, but as we afterwards found him in far greater abundance and had ample opportunities of listening to his melody, I shall defer an account of him to a later period. Suffice it to say now that he is a constant winter visitant of the valleys of California, but, so far as observation goes, he is never betrayed into the faintest suggestion of a song at that season — only a short, low, *chuck! chuck!* as he retires into the shadow of the shrubbery.

Another bird, Townsend's sparrow, singularly like a thrush in general coloration, although profoundly different in structure, was first encountered at Wrangell. In California he is abundant all winter long. He is about the size of a thrush, but whereas the bill and feet of that bird are long and slender, those of Townsend's sparrow are short and stout. He is a great scratcher and may often be found in his quiet retreats in woodland thickets by the noise he makes scratching away the leaves to get at his food.

I saw a belted kingfisher here, and greeted him as an old friend, for wherever one may go in northern North America, if a stream of water large enough to hold fish flows through the country, his big crested head and dark blue and white body are to be seen.

At about nine o'clock on the evening of the day we left Wrangell we cast anchor in the beautiful waters of Taku Harbor. Here Dr. Merriam went ashore with a small party to put out traps for mammals, and I had an opportunity to walk by the stream and listen to the enchanting song of the russet-backed thrush. This thrush is a common summer resident of the Pacific Coast and is the most accomplished song bird of the region. It is a trifle larger than the dwarf hermit thrush and its back is uniform russet-brown. Both species have a distinct ring of white or buff around the eye, and both have the white breast more or less tinged with buff and conspicuously spotted with triangular dusky-brown marks.

Like birds of passage we hurried on. Gliding up the wonderful reaches of Lynn Canal, past glaciers and towering mountain summits, we arrived at Skagway, and on the following morning took the train for the summit of White Pass, now so famous as the highway to the Klondike.

It is not strange that few birds choose so drear a place for their summer home. The wonder is that any are hardy enough to undertake the rearing of a family there. It must be a blithe heart indeed that can sing all day long with thick fog overhead, and bleak rocks, half buried in snowdrifts, underfoot; but birds there were, singing their frail, sweet songs in defiance of the rudeness of nature. We observed three species, two of which spend their winters in the valleys of California — the golden-crowned sparrow and the American pipit or titlark — while the third, Hepburn's leucosticte, scorns to haunt the valleys at any season, but follows the margin of the snow, year in, year out.

The golden-crowned sparrow arrested the attention of our entire party, not only at White Pass but at other points where it was found in great numbers. To me it was an old friend, for throughout the winter it is one of the most abundant of California valley birds, but to those of the

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GOLDEN-CROWNED SPARROW, ZONOTRICHIA CORONATA

White Pass, June 7, 1899. Male

party who came from east of the Rocky Mountains it was a stranger, although first cousin of two common eastern species — the white-throated and the white-crowned sparrows. Its typical song, though neither vivacious nor varied, is so plaintively appealing as to win an audience where other birds may chant their strains to deaf ears. It is high and pensive, descending in a fine, liquid cadence of three lingering notes. Some of our party, listening to its song at Kadiak, fancied that the second note was broken by a short halt, but after hearing it for many years during the winter time, and again in its Alaska home, its characteristic strain seems to me to consist of three notes in a descending scale, often more or less slurred.

At White Pass I was not a little surprised to notice that its song, although precisely the same in quality as during the winter time, had a different sequence of the notes, the highest tone being sounded first, followed by the lowest, and lastly by the medium tone. I supposed at the time that its summer song differed in this respect from its winter strain, but at other points in Alaska we heard the well-known song of its winter pilgrimages.

Some wag on the White Pass railroad has christened this bird 'Weary Willie' because he is forever singing "I'm so tired!" As to the singer — he is a simple sparrow of medium size, with a back of streaked brown, chestnut, and black, an ashy rump, and a plain ashy-gray breast, turning to olive-brown on the sides. His distinctive mark is his golden crown, changing to ashy-white on the back of his head and bordered with bands of black.

Of the pipit and leucosticte we shall see more anon, so we can now leave them flitting about the snowy summits of White Pass, while we hurry on our way down the mountains by train to Skagway, and by steamer once more through the wonderful Lynn Canal into Glacier Bay.

When we finally cast anchor before Muir Glacier, birds were forgotten as we stood under the spell of the ice. Indeed, it scarcely seemed credible that birds could be in such a place—so cold, austere, and terrible it appeared. Of course, we expected to find some of the hardy sea birds, and so were not surprised to notice glaucous-winged gulls flying about the inlet as in other parts of the inland channels. One might fancy their feet would get cold, as numbers of them rested upon floating cakes of ice. The California murre, one of the species of diving birds, which we afterwards encountered in great abundance, also rested upon the bergs, and violet-green cormorants swam with agile movements in the icy water. The cormorant when on rocks or ice is a most ungainly bird, but is interesting for all that. Its body is heavy and clumsy, and its slender stretched-out neck seems to end in a long, narrow bill, so slight is the enlargement of the head. A naked skin-pocket covers the throat, and the clumsy toes are all connected by a web. The violet-green cormorant, as if to atone for its ungraceful outline, is resplendent in a coat of burnished blackish-green, varied with purple iridescence on the neck. Its gular sac, as the naked skin of the throat is called, is coral red, and its bill and feet are black. To add to its individuality, this species has two crests, one on the top of the head, the other on the back of the neck, while the flanks are adorned with patches of loose, white feathers.

A few black brants were observed flying overhead, an occasional raven flapped along the shore, and here we had our first glimpse of the beautiful harlequin duck, swimming amid the floating icebergs. Here, too, was that peerless diver, the Pacific black-throated loon; the marbled murrelet sported in the icy waters, and the pigeon guillemots and tufted puffins gave variety and animation to the scene.

1. VIOLET-GREEN CORMORANT, PHALACROCORAX PELAGICUS ROBUSTUS
Point Gustavus, Glacier Bay, June 11, 1899.

2. WHITE-CRESTED CORMORANT, PHALACROCORAX DILOPHUS CINCINATUS
Kukak Bay, Alaska Peninsula, July 1899.

BY L. A. FUERTES.

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Of the more delicate land birds, however, it seemed impossible that any could exist in such a spot. At the head of the inlet the glacier wound down from the distant mountain range, and discharged its bergs into the water with an intermittent roar like thunder. Upon both sides the shores were treeless and precipitous, save where the dreary monotony of the moraine stretched out its undulating mass of gravel. The mountains were dark, forbidding, and steep, with nothing to cover the naked rock or soften its outlines. To search for song birds in such a spot would seem an idle task.

On a memorable Sunday morning I went for a tramp in company with John Burroughs. Provided with lunch, field glasses, and camera, we were landed on the eastern shore. Crossing the rough mass of gravel piled into hills and valleys, we jumped the rushing torrent that carried the melting water from the glacier, and began to ascend. It was steep, rough work, compelling us to stop frequently for breathing spells. Climbing up the wall of shale and slate we found ourselves upon a little flat space where a clump of low alders grew, and here, to our surprise, the dainty summer warbler in his golden coat, with the fine reddish streakings upon his breast, was singing the same animated song that he sings along the Hudson River and in the groves of California. He and his little mate had sought out this oasis amid rock and ice, and hither they had come the long journey to rear their brood in seclusion.

We rested amid the alders, took a drink from the mountain torrent that poured down over the rocks from the snow drifts above, and finally started on what proved to be a very hard, rough scramble over the precipitous shale to the summit.

After we had looked long and lingeringly at the view, we turned our attention to the birds, a goodly number of

which were singing about us. I was delighted to hear the American titlark or pipit in its full summer frenzy of song. Throughout the winter large flocks of this species haunt the fields and open hillsides of California, running about over the ground and pausing every now and then with a peculiarly characteristic teetering motion of the body. At that season I have never heard any note save their faintly reiterated lisping call. They are simply colored, with an olive-brown back faintly streaked with blackish lines, and a pale brownish-buff breast covered with dusky marks. In summer time the colors are much clearer and sharper, the wings and tail being nearly black, varied with white, and the breast becoming a warmer brown. But the song of the pipit interested us more than its dress. This blithe sprite of the northland, lark that he is, would fly straight up in the air, singing in an excited manner a flute-like, though very simple, crescendo — *twit! twit! twit! twit!* — and then suddenly descend, still singing and fluttering, pausing only in his breathless strain as he alighted on the ground in the gorge hundreds of feet below, where, no doubt, his mate was awaiting him with hushed expectancy.

Again, as at the summit of White Pass, the golden-crowned sparrow sang in the inverted sequence of notes, but it sounded none the less sweet and appealing. Among the stunted alder thickets the dwarf thrushes were singing in great numbers. Their strain, while much thinner and finer than the song of the russet-backed thrush, has a truly spiritual quality that lends it charm. It is a sweet, silvery call with a slight liquid gurgle in its trill, and gives the effect of distance even when the singer is close at hand.

Townsend's sparrow was also common and in song. Its note was frequently varied, with just a suggestion of the song sparrow's tone. The syllables most often repeated sounded thus: *ts-wi! ts-wi! tsi-tsi-tsi'-a!* We

HARLEQUIN DUCK. HISTRIONICUS HISTRIONICUS

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were interested in watching that other hardy member of the finch family which we grew to associate with all our rambles on the heights — Hepburn's leucosticte. It is a variety of the gray-crowned leucosticte, or rosy finch, as I prefer to call it — a rather large sparrow of a dark brown color, varied by an ashen-gray patch on the back of the head, and with the feathers in the vicinity of the tail broadly edged with rosy red. We found these birds in pairs running about on the crusted snow, picking up food on its surface and along its edges. The only note we detected was a deep-toned sparrow twitter, uttered on the wing.

Still another hardy bird that rears its brood not far from the banks of snow, is the white-tailed ptarmigan. In many parts of Alaska we found this species and the willow ptarmigan abundant and surprisingly tame. They are beautiful birds, a trifle smaller than a grouse, and famous for their seasonal changes of plumage, the entire body becoming pure white in winter and turning more or less brown in summer. Thus at all seasons the plumage harmonizes completely with its surroundings, the finely mottled brown, black, and white of the back and breast blending as perfectly with the rocks upon which it rests in summer as does the white with the snow of winter.

Although we had our first glimpse of these interesting birds during the second week of June, we observed several which were nearly pure white and others which showed but small patches of dark. Is it not possible that where they dwell so close to the line of perpetual snow, the adjustment of coloration to environment is so complete that the loss of the white plumage is much retarded or restricted? A white-tailed ptarmigan stood looking at us only a few feet away, seemingly dazed by the novel sight of man. He was a beautiful white fellow with only the conspicuous orange-yellow skin above the eye showing by way of

variety. For some moments he stretched his neck about, looking now this way, now that, and then, starting off with a queer, guttural chuckle, flapped his wings until he was well launched in air, when suddenly checking his flight he sailed with a graceful swoop down to the level reaches of the moraine far below.

Such was the life in this aerial garden where, beside banks of eternal snow, birds sang and flowers bloomed unheeding the pageant of splendid desolation stretching in vast sweeps from horizon to horizon. What miracle could be more impressive than this of the rude rock mother, cradling upon her breast, as the ice slipped away, the gentle epilobium and the timid thrush! What pictures it brings to mind of the days long gone when the ice crowded down from the north, sweeping all living things before its resistless march, followed by its slow and reluctant retreat, and by the eager rush of life into the region which it had laid waste! Here, to-day, is the living counterpart of the ice age. With the same dauntless spirit, the same simple trust, now as then, are the birds and flowers thronging to the threshold of the ice king's palace, to reclaim and make lovely the land that has been visited with utter desolation.

On awakening one morning at Yakutat we found our ship anchored in front of the Indian village. A small party of us made preparations for an early start ashore, with equipment for a few days in camp. We selected a spot upon a sandy beach in a little cove about a mile from the village, a clear stream emptying into the bay close by. After breakfast in camp Mr. Ridgway and I started out in our rowboat to look for birds. We first noticed a flock of white-winged scoters swimming near a rocky point, where they were no doubt breakfasting on mussels. They are clumsy, black sea ducks with white wing spots and with the upper mandible greatly swollen at the base

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and colored a brilliant red. The female lacks the swelling of the beak and is dull grayish-brown in color.

Next a flock of Arctic terns was seen — slender, pale-gray and pearl-blue, swallow-like cousins of the gulls, with long forked tails, black caps, and sharp, carmine-colored bills. They were airily fluttering over the water and splashing in every now and then for a fish. Their high, creaking rattle of a cry was constantly uttered as they fluttered and gyrated over the spot where a school of small fish was swimming.

We rowed to the settlement, which is composed of houses built in the most hideously modern fashion with clapboards and paint, and, upon landing, strolled off into a partly cleared spot where birds seemed plentiful. Here Mr. Ridgway found a race of song sparrow he had recently described, and collected such specimens as he needed for further studies. Townsend's sparrow was also abundant and in full song. We heard the bright notes of the summer warbler and found the pileolated warbler in numbers. This golden sylph with its cap of black has a dainty though rather jerky song, a fine, rapidly uttered pipe — *tsi-tsi-tsi-tsi-tsi!* The dwarf hermit thrush uttered its silvery gurgling song every now and then — *twe'-ti-twe-dle-de-dle!* and occasionally from the forest we heard the strain of the ruby-crowned kinglet — a surprisingly loud and clear song for so small a bird. The lutescent warbler, in olive-green and dull yellow, trilled amid the bushes, a strain not unlike that of the chipping sparrow, but not so high-pitched and prolonged. Altogether there was a merry chorus about the Indian village which did much to atone for the prosaic appearance of the settlement.

On the following day Mr. Ridgway and I again went for a ramble, taking advantage of a lull in the rain, that fell much of the time we were in camp, and were rewarded by the sight of several previously undetected birds.

The woods back of our camp were like other forests of the Alaska coast, dense and impenetrable. Hemlock boughs reached out their flattened sprays, and the Sitka spruce held forth its branches tipped with bright new tassels. Raindrops clung to every leaf and showered us with spray as we passed under the overhanging limbs. Mosses, liverworts, and lichens covered the ground and crowded upon the trunks of the trees. At every step the foot sank into a cushion of heavy velvet or a pool of water. Ferns grew in profusion, and bright green scouring-rushes fringed the forest. Salmon berries and the famous Yakutat strawberries were in blossom. Besides the birds we had previously observed as abundant in the vicinity, we saw the pert little brown winter wren, and heard its merry, wheezy, rattling attempt at a song. Here also Mr. Ridgway secured a specimen of the Kadiak pine grosbeak in full plumage. We had observed a number of birds of that species in the forest, but from their note had mistaken them for purple finches. This large, beautiful finch, with its very thick beak and showy rosy-red plumage, varied on the back and belly with ashen-gray, is an inhabitant of the forested regions of Alaska, where it rears its young in the solitude of the dark groves of spruce.

During the two following days, which were spent aboard ship cruising about Yakutat Bay, we secured specimens of both the pomarine and parasitic jaeger, and I observed one of the latter birds pursuing an Arctic tern which held a fish in its beak. The jaegers are the winged pirates of these northern seas. They belong to the gull family, but differ much from other members of the group, both in habits and plumage. Imagine a trim-built bird of vigorous and sustained flight, agile in turning, and impetuous in attack — a bird about a foot and a half in length, with a rather long tail terminating in two elongated central feathers projecting two or more inches beyond the rest — such

PAINTING BY L.A.FUERTES.

WILLOW PTARMIGAN.

A. HOEN & CO. BALTIMORE.

is the jaeger in form. In color it is dark brown or sooty-slate upon the back, and either pure white or brownish-black on the underparts.

While walking in the vicinity of a camp of Indians at the head of Yakutat Bay, several of us encountered a mother willow ptarmigan with her brood of chicks. Dr. Merriam caught one of the young birds and its cries speedily attracted the hen who came to within three or four feet of us in her eagerness to effect the release of her young. On setting it free the entire brood speedily disappeared in the bushes. So completely do the ptarmigans rely upon their coloration for protection that at Glacier Bay a bird sitting on her eggs allowed Dr. Palache to pick her up without making the slightest effort to escape.

Our next point of exploration after leaving Yukutat Bay was within the sheltering recesses of Prince William Sound, where reaches of dark forest fringe the shores and snow-covered ranges tower in the background. These uninhabited wastes seemed almost destitute of bird life, and one might toil for hours through the tangle beneath the dark spruce trees without hearing a bird lisp. At times the merry chatter of a small flock of chestnut-backed chickadees would interrupt the silence, or more rarely the harsh notes of Steller's jay, to be followed by a still deeper calm when the wind amid the branches would breathe like some vast sleeper that could not be aroused. At Orca I heard a western robin sing.

During a day of exploration in that wonderful inlet which our geographers named College Fiord, we found birds somewhat more abundant, although still very limited in the number of species. Indeed, the only land bird which seemed thoroughly at home here on the verge of the glaciers was Townsend's sparrow, which frequented the dwarf alders of the moraines. Dr. Fisher recorded the redpoll linnet, another hardy bird of the north-

land that visits the United States only in the coldest weather. Upon a low, rolling shore of gravel between two of the smaller glaciers of this remarkable fiord we came upon a nesting place of short-billed gulls and Arctic terns. The nests were on the ground and were formed by making a depression in a clump of grass and epilobium, sometimes scantily lined with additional sticks and dried grass. Indeed the terns made almost no attempt at nest building, depositing their eggs upon the stony ground with but the flimsiest lining of loose grass. The eggs were marvelously protected in their exposed position, their color blending so perfectly with their surroundings that we frequently were on the point of treading on them before detecting their presence. The eggs of the two birds are very similar in color, although those of the gull are of course much larger. The ground color is olive, irregularly spotted with brown and obscure lilac. The gulls' nests contained, as a rule, three eggs, while most of the terns' held but two.

The short-billed gull in breeding plumage is a beautiful bird, with its snowy white body, its delicate pearl-gray mantle, and its black flight-feathers tipped with subterminal spots of white. We noted the dull yellow of its feet, its waxy-yellow bill, its gray eye and the striking spot of vermilion on its eyelid. The parent birds hovered with extreme solicitude over the spot where their eggs were concealed, uttering a short, insistent note of a decidedly squeaky and unmusical quality — *tup! tup! tup! ye' up! ye up!* Sometimes the cry was varied thus: *ke-up! kup! kup!* and they also had a higher uninflected cry. We saw a number of black oyster-catchers running along the beach — big waders with long, blunt, vermilion beaks, long, agile legs, and blackish-brown bodies.

Another day during our stay in Prince William Sound we visited one of the alpine meadows which are so char-

PHOTOGRAPH BY CURTIS

HEATHER ISLAND, COLUMBIA BAY

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acteristic of the forested portions of Alaska. It is with a thrill of pleasure that the traveler encounters one of these secluded meadows hemmed in on all sides by trackless forests or untraveled waterways. Imagine an open glade half a mile in length, with gently undulating surface, and here and there a dwarf spruce or an alpine hemlock, twisted and gnarled, looking in its fantastic shape like the handiwork of a Japanese gardener. A carpet of dense moss, in which the feet sink at every step, covers the ground, and here and there are pools of water, imaging the frail flowers which sway upon their banks. Here grow the golden geum, the dainty little white stars, both the pink-belled and white-belled heathers, the small bunchberry or ground dogwood, the beautiful purple nodding dodecatheon, the waving white fluffs of the cotton grass, and the minute little purple bells of butterwort. A solitary dwarf thrush stood on the edge of the meadow with a mouthful of grubs for her little ones and a western savanna sparrow sang its fine wheezy little *tsip, tsip, tr-iĕĕĕ'!* — but of other birds we saw no sign in all this lovely wilderness of flowers. In the edge of the woods near by, Dr. Merriam shot a Canada grouse, and upon the shores the northwest crows cawed and pranced, but for the most part the alpine meadows as well as the forests surrounding them were seldom enlivened by the voices of birds.

Of all the regions visited in Alaska, none seemed so much like home as Kadiak, with its green hill slopes, its inviting woodlands, its flowers and its birds. Here, tucked away on an inlet of the ocean, nestling at the foot of steep grassy hills, lay the little hamlet, unheeding the far-away busy world, and fast settling into an eternal sleep, untroubled save by dreams of the historic past. It was the first of July when we arrived and the air was full of the balmy cheer of summer. Shortly after landing I went

for a stroll with Professor Ritter, and we fancied ourselves treading again the well-loved coast ranges of California. The hills rise in a very steep slope, but they are covered with a heavy turf, affording firm and easy footing. The entire mountain side was a garden of beautiful flowers. Fleur-de-lis lifted their stately purple heads, and the blue polemonium was scattered near and far. A deep pink-purple orchid, with clusters of flowers on a stalk, grew here and there, and white windflowers crowded the slopes. Then there were lady's slippers, violets, forget-me-nots and fritellarias — making in all the most exquisite pageant of wild flowers we had ever seen.

In the midst of this flower garden were many birds in song — the large dark Kadiak song sparrow, the savanna sparrow, summer warbler, pileolated warbler, dwarf thrush, and, most abundant of all, the golden-crowned sparrow, singing the same plaintive song that we hear in the valleys of California throughout the winter. It was a perfect medley of sweet tones ringing over the mountains far and wide — a chorus of tender minstrelsy in a setting of innumerable flowers. A tangle of dwarf alders beside a stream that trickled down the mountain side was the rendezvous of the birds, and here we watched their merry-making. Below us were the town beside the narrow inlet, islands, bays, and mountains with green slopes, dark masses of forest, and in the distance, ridges topped with snow.

One morning I started off alone for a walk in the woods to enjoy the birds and flowers, taking the road that led into the spruce forest and wandering on until I found a grove of beautiful moss-covered old trees. It was Sunday, and in the distance the bells of the Russian church were clanging and jingling — big bells and little ones all ringing at once. I was in an open park-like glade, with small spruce trees all about, and glimpses of verdant hill-

PHOTO. BY CURTIS

ELSON, BOSTON

LILY POND NEAR KADIAK, ALASKA

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sides, their summits lost in mist. The air was balmy in spite of a foggy atmosphere, and on every side was a glorious chorus of bird songs — the bell-like tones of the dwarf hermit and gray-cheeked thrushes, the sweet strain of the varied robin, and the plaintive, long-drawn whistle of the golden-crowned sparrow. The animated, sustained, and rapid *tsit-tsit-tsit-tsit* of the pileolated warbler, the chatter of the redpoll linnets and the hoarse croak of the raven, all sounded together or in rapid succession.

The redpoll is a small bird of the finch family, with fine sharp bill and dull brown and gray streaked plumage. The head is reddish-brown, or, in full-plumaged males, bright rosy-red, the throat is black, and when in full plumage a bright rose color tinges most of the body. The note of the redpoll is similar to that of the goldfinch, but with more of a chatter in its quality. The sweet, direct, loud, burring trill or whistle of the varied robin was a very characteristic strain, differing from any other bird song I have ever heard. It is without modulation — a single sweetly penetrating note with just the slightest gurgling rattle in quality, and pitched in various keys. It may be represented thus: *Brrrrrrrrrr!* I saw some of these birds among the spruce trees — quiet and dignified, shunning society. One had food in its bill evidently intended for its young. The call note was a low, liquid *chup! chup!* This noble thrush of the northwestern forests is about the size and build of a robin. Its breast is orange brown, marked with a broad black crescentic collar, and its back is dark slaty or plumbeous. A conspicuous stripe above the eye and double wing-bars are orange-brown or buffy in tone.

The golden-crowned sparrow, besides its song, has two distinct call notes — a fine, lisping *tsip! tsip!* which it utters during its winter sojourns in California, and a sparrow-like chirp — *chip! chip!* Townsend's sparrow sang

a sweet, lively ditty which I transcribed into these inadequate phrases: *péa-quit! quit!* — *tsit-a-wié!* — *péa-ă-quit-quit-quit-a-wie!* Its call note was a thick-billed sparrow chirp.

I spent some time listening to the thrushes in order to distinguish the songs and calls of the gray-cheek from those of the dwarf hermit. The two birds may be readily told apart by the paler and grayer brown of the former species contrasted with the warm rufous of the tail and coverts of the latter. The gray-cheek sang more like a russet-backed thrush, although its strain was not so full and rich. Its song may be represented thus: *qui-qŭĭt-wi! qui-qŭĭt-qŭĭt!* the quit always with the characteristic liquid gurgle of a thrush. At other times it sang, *tsi-tsi-qŭĭl'* — *tsi-quil'!* or *qui-quil'! qui-quil'!* Its call note was a liquid *pe'-a! pe'-a!* In contrast with this was the call of the dwarf thrush, a peevish cat-call *chee! chee!* The characteristic nervous flirt of the wings accompanied this call. At times I heard them utter the note so commonly sounded during the winter months — a low, emphatic *chuck! chuck!*

Here also the summer warbler was in song, and the Kadiak pine grosbeak. In these same woods I met for the first time the long-tailed chickadee, a western race of the familiar eastern species, from which it differs in its slightly paler coloration, and, as its name implies, in the possession of a longer tail.

Upon another occasion Mr. Burroughs and I went for a ramble in the forest on Wood Island, opposite the town of Kadiak. It was a warm, beautiful day, and the woods were in a peculiarly inviting mood. We started off from the end of a little pond at the site of an old Russian sawmill, and took a cow trail into the timber. The first song to attract our attention was that of the western winter wren — a merry sustained little jingle, but without any

POLEMONIUMS from KADIAK, ALASKA.

1 & 2. Polemonium caeruleum Linn.
3. Polemonium humile Willd.

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fulness of tone or melody. Next we found a magpie — a fine-plumaged saucy fellow in his coat of white and burnished black, his long tail trailing after him as he fluttered about in the bushes. Much to our surprise the magpie proved a common and characteristic bird.

As we worked our way carefully through the masses of devil's club, with its broad-spreading indented leaves growing on a tall bare stalk, bristling with spines as sharp as porcupine quills — over or under fallen trees and around the bogs we encountered now and then, we heard the fine lisp of the western golden-crowned kinglet, the chatter of the long-tailed chickadee and the sweet note of the varied robin. The golden-crowned kinglet is a beautiful little bird — a tiny fellow with a plain gray breast and an olive-green back; but of all wood creatures he is the most perfectly crowned. Upon the top of his head is a spot of flaming orange set in yellow and bordered with bars of black, next to which, just over the eyes, are lines of white. His little queen has a similar, though less brilliant crown, in which the orange flame is replaced by yellow.

After leaving Kadiak we had no opportunity of making note of bird ways until we touched for an hour or two at Sand Point on Popof Island, one of the Shumagin group. We had passed well beyond the forested part of Alaska, and were destined to see henceforth only grassy mountain slopes and Arctic tundras, with dwarf alders, willows, and birches nestling in the hollows. A goodly number of birds were abroad on the morning we anchored off Sand Point. From the ship's deck I heard the chatter of barn swallows (which, by the way, were also abundant about the village of Kadiak), the plaintive strain of the golden-crowned sparrow, the simple ditty of the Aleutian song sparrow, the sprightly song of the summer warbler, and the harsh call of the magpie. The song of the dwarf

thrush sounded sweet and pure, chiming afar off in silvery tones. After breakfast Mr. Burroughs and I went for a brief stroll ashore, and discovered in addition to the birds previously heard, the redpoll and Townsend's sparrow. A mother song sparrow started up suddenly at our feet, and a search of the neighborhood revealed the little grass nest skillfully tucked away in a niche under an overhanging bank. The greenish brown-spotted eggs seemed large for a song sparrow's. We noticed a bald eagle soaring in the air suddenly poise on fluttering wing like a hawk looking for a mouse, and then float serenely on. Later we saw a pair sitting on the rocks on the beach.

Our hasty survey of the birds was interrupted by a summons to return to the ship and ere long we were steaming on toward Unalaska. Here our stay was so brief that I noted only three birds among the grassy plains and hills that glowed with innumerable wild flowers — the Alaska Lapland longspur, the Aleutian leucosticte or rosy finch, and the raven. The longspur is a summer resident of boreal fields, where it tarries while the flowers bloom, and then reluctantly retires southward, keeping pace with the advance of the drifting snow. Its head and breast are black, its back is black streaked with buff, and its underparts white, the sides streaked with black. A broad buffy streak above the eye interrupts the black of the head, and a collar of chestnut extends over the back of the neck. The song of the longspur is loud, sweet, and clear, and uttered upon the wing, reminded some of our party of the rapturous strain of the bobolink.

The Aleutian rosy finch is a large, dark chocolate-colored sparrow with an ashen hood on the back of the head and a black forehead. The rear portions of the body are more or less tinged with rose. Ravens were about the settlement in great numbers and as tame and impish in their manners as at other coast settlements.

PHOTOGRAPH BY U. S. FISH COMMISSION

JOHN ANDREW & SON

UNALASKA HILLSIDES

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On anchoring off St. Paul Island, one of the Pribilofs — the famous fur-seal islands of Bering Sea — our entire party went ashore in boats to inspect the seals on their native beaches. On the verdant hills the Aleutian rosy finch and Alaska Lapland longspur were the common birds, and a royal time they had of it amid the fields of frail golden poppies and pale-blue polemóniums. With such a coverlet in which to nestle, what cared they if the salt winds swept down from the Arctic Sea! There were acres of lupines, too — beautiful blue-purple clusters where the Pribilof snowflake might hide.

Along the shore we saw the kittiwake gulls in great numbers, and both the horned and tufted puffins. The least auklets nested in large assemblies among the rocks close to the breaking surf, and Pallas's murre was present in immense flocks.

While our ship is plowing northward over the inhospitable sea, it may be well to take a general survey of some of the low forms of bird life which delight in its chill air, congregating in vast numbers upon its storm-beaten rocks to rear their young.

The sea birds are divided into five easily recognized groups — the diving birds, including such queer creatures as the auks, murres, and puffins; the long-winged swimmers, into which group fall the gulls and their allies; the tube-nosed swimmers, which are the most perfect birds of flight and embrace the albatrosses and petrels; the wholly-webbed swimmers, in which division the cormorants are placed; and the ducks, geese, and swans. Each of these groups is abundantly represented in Bering Sea, for it is in such northern waters that the sea birds love most to dwell.

The puffins are among the most outlandish birds which ingenious mother nature has contrived to evolve. They are trim in build, about a foot in length, with very short

feet and webbed toes. When seated on the rocks they assume an erect posture, and their small heads, set close down upon their shoulders, look ridiculously insignificant in comparison with their exaggerated beaks, which are very much flattened sidewise and immensely spread out from top to bottom. As if to heighten the comic effect, the bill is brilliantly colored, and the stupid little face behind it appears serenely unaware of its oddity. This great beak is largely an appendage of the breeding season and is cast like the antlers of a deer at the end of that period. The tufted puffin is brownish-black above and dark grayish-brown below, with a conspicuous white patch on the side of the face. In the breeding season it is ornamented with a long heavy fluff of pale yellow feathers extending backward from the eye on each side of the crown, and its great beak is scarlet with a dull yellow base. The horned puffin is glossy-black above and white below, the white extending up on the sides of the face. It has a small leathery excrescence on the upper eyelid which has given it its name, and its bill and feet are a brilliant red.

The least auklet, one of the smallest of diving birds, is very plainly attired, with its black back and white breast varied with dusky mottlings. Its short, stout beak is bright red, and it has a series of fine white hair-like plumes on the sides of the head back of the eyes. In this same group of diving birds are the murres, which inhabit the entire Pacific coast from California to Bering Sea. The murres are a foot and a-half or less in length, with long, sharply pointed, and moderately stout beaks, well formed for securing their funny prey. Their heads, throats, and backs are a smooth, dark grayish-brown or brownish-black in color, sharply contrasted against the white of the underparts. The California murre has the top of the head and the back of the neck smoky-brown, the same parts being black in Pallas's murre. The latter species also has

A. HOEN & CO. BALTIMORE.

1. Tufted Puffin, Lunda cirrhata
2 Horned Puffin, Fratercula corniculata

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a decidedly thicker bill. Both forms are present in vast multitudes about the rocky islands of Bering Sea, the Pallas's murre being especially abundant and outnumbering all other sea birds in the ratio of fully ten to one.

Comparatively few birds were seen as we steamed into a brisk head wind under a lowering leaden sky. Murres whirred past in flocks every now and then, and occasionally a Pacific fulmar followed in the ship's wake. The fulmar is about as large as a fair-sized gull, but with longer and more slender wings, which are held rigidly outstretched much of the time in flight. Although an ally of the albatross, the fulmar has not the supreme command of the air possessed by that bird, and every now and then must resort to flapping its pinions. This species is peculiar in having two phases of plumage without reference to sex or season. In the dark phase the body is a deep, smoky-gray above and below, while in the light phase the plumage is similar to that of many adult gulls — pure white with a bluish-gray mantle over the back. Many that we saw were in a mottled plumage, largely white but with dark patches on their backs.

At times a silent bird with slender, far-reaching pinions would glide out of the mist, gyrating back and forth over the crested waves without a tremor of its rigid wings. It looked like a small albatross with dark, sooty-gray or blackish plumage, and we made it out to be the slender-billed shearwater. It is a creature of the boundless ocean, as unimpeded in flight as the wind which sustains it.

A flock of harlequin ducks flew past with rapid wing strokes. From a distance they looked black against the leaden sky, but as they came abreast of us the white bars across the head were very conspicuous. When they were gone there was nothing left to vary the monotony of gray until two or three kittiwake gulls came sailing daintily along. The kittiwakes are snowy white save for the

pearl-gray of the back and wings and the sharp black tips to the flight feathers. Two species inhabit Bering Sea, the Pacific kittiwake which we had encountered at various points on the Alaska coast, and the red-legged kittiwake which is found only in these northern waters.

On the coast of Siberia, where we touched at Plover Bay, the birds seemed limited to a very few species. Snow buntings and Lapland longspurs were abundant, and we first noted there the Siberian yellow wagtail. This bird with its bluish-gray crown and back of neck, its olive-green back and bright yellow breast, is a common inhabitant of the tundras about the shores of Bering Sea.

In the waters of Plover Bay we found the pigeon guillemot abundant. It is a near relative of the murres but is smaller, with a dark body, conspicuous white wing-patches, and brilliant red feet. Pallas's murre was very common and many kittiwake gulls were observed flying about the bay. We also saw flocks of least auklets swimming on the water, and noted for the first time on our journey spectacled eiders—the males with their conspicuous white backs contrasted with their black breasts, and the females plain mottled brown.

At Port Clarence on the Alaska coast, where our next stop was made, I had little opportunity of observing the birds. The longspurs, snowflakes, and Siberian yellow wagtails were the characteristic land birds of the tundras, and the golden plover, in mottled coat of golden-brown above and black below, with its loud, clear, flute-like call, was fascinating to those who had the good fortune to encounter it upon its native heath.

We reached Hall Island in the evening, and landed upon a narrow gravel beach. A stream came down to the sea at this point, making the high ground accessible. On either side rose steep, unscalable cliffs of lava. Sea

GULLS ON ST. GEORGE ISLAND, PRIBILOF GROUP

MURRES ON WALRUS ISLAND, PRIBILOF GROUP

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birds innumerable were fluttering about the rocks. We passed a murre with its head tucked under its wing, sleeping on the water and rocking with the waves like a beautiful little boat. Night had come, although the sun still lingered above the western horizon. The steamer was vanishing in the direction of St. Matthew Island. Our little party was left alone on the beach, the waves swashing up on the pebbled shore and the dark cliffs about us swarming with sea birds. There were puffins, pigeon guillemots, and least auklets, besides the vast company of murres, and the cackling of innumerable voices made an incessant murmur above the sound of the sea.

Upon climbing up the slopes from the shore we found ourselves upon an Arctic tundra — a great rolling plateau of bog, with pools of water in every hollow, and flowers growing in bewildering profusion. A bed of moss spread across the island from cliff to cliff carpeting everything with its soft tones of gray, brown, purple, and green — parts of it like velvet, soft and yielding to the tread, and other parts spongy and soggy. The masses of flowers wove richly glowing patterns into the carpet, in purple, blue, yellow, and white — the purple primrose and pedicularis, the blue polemonium, the yellow poppy, a fine golden cowslip, and the white-cupped dryas.

It was fitting that this fairy garden in the midst of a stormy sea should be inhabited by one of the most chastely adorned of birds, the hyperborean snowflake. Verily a snowflake this exquisite creature is, as it whirls through the misty glow of night among the wastes of flowers. Its plumage is as candid as a freshly opened lily. The spotless white shows more perfectly by contrast with the jetty bill and the blackness of the wing tips. At the edge of its snowy tail are two other black dots. It is a sparrow transformed into a wraith of the snow. It is adorned with the ermine of kings, and a king it seems amid the realm

of flowers. Its little mate has the back streaked with black and more of the same on her wings and tail, but otherwise her plumage is white like that of her lord and master. Nor did the song of this snowflake prove disappointing. It was a loud, sweet, flute-like warble, frequently uttered on the wing, and much resembles the notes of the western meadow lark, although rather higher, shriller, and shorter. We noticed the birds about the edge of the cliffs as well as upon the tundras, and their business in such exposed rocky spots was explained when a nest was discovered placed far back in a crevice in the rocks upon the cliff wall. The nest was made of grasses and contained five rather light greenish eggs dotted with pale brown. Later in the evening another nest was found containing young birds which came to the edge of the hole to be fed. The abundance of the Arctic fox upon the island no doubt explains the unusual places in which the snowflakes tuck away their homes.

The Lapland longspurs also were very common upon Hall Island, the males with their fine black chests and faces and chestnut collars; the females in their more modest, streaked plumage. The dark Aleutian rosy finch was present in numbers, and some of our party stumbled upon a snowy owl with a family of droll little owlets.

Upon approaching the edge of the cliffs a wonderful scene lay below us. Some great black splinters of rock two hundred feet high stood out in the water close to the shore, the waves dashing about their bases, while all over their sides, upon every ledge, crowded the sea birds. Below us and opposite on the precipitous volcanic face of the island was an almost solid front of birds—mostly Pallas's murres—bustling, bobbing, and bowing, some sitting passively upon their single eggs, and many standing, with their faces turned toward the rock wall which rose above them. The myriads of birds uttering their low, hoarse, crooning

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HORNED AND TUFTED PUFFINS

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cry made a perfect tumult of sound. Horned puffins stood here and there, showing their orange-vermilion feet, their bright-yellow bills tipped with the same orange-red, their white breasts and faces and dark-brown backs, with a line of black extending around the face and bounding it. As we looked over the cliffs we saw a flock of harlequin ducks swimming in the water hundreds of feet below. Fulmars were flying about here and there, and one was seen sitting upon her egg on a ledge of the cliff.

As I stood watching the birds, a little paroquet auklet sat confidingly close beside me upon the cliff. It had a red, snub, upturned bill, gray feet, and a fine white line of feathers extending back of the eye. It sat alone on the rocks with its feet planted squarely upon the ground, holding the body erect; its breast was white, its back dark grayish-brown and its throat light grayish-brown — a sober little fellow with a note that seemed like a low, trembling, squeaky wail. I noticed a cormorant with conspicuous white flank patches (probably the red-faced cormorant) and many kittiwake gulls. Another gull that we found here, for the first time, was in the purity of its plumage as lovely among sea birds as the hyperborean snowflake among land birds. Indeed the great Point Barrow gull is without a trace of black — the snowy whiteness of its plumage being relieved only by the pale pearl-blue of its mantle, and by its bright-yellow beak, spotted with vermilion near the tip of the lower mandible. It is one of the noblest of sea birds, and the picture of a creature so lovely in such a dreary region, swinging about the dark storm-swept cliffs of Bering Sea, riding upon waves and air and mastering them, is one that once seen will long haunt the memory.

At eleven o'clock the steamer returned and we left the beach, the fire of driftwood on the shore still glowing through the mist as we rowed away.

The following day we spent some hours exploring St. Matthew Island. Its shores and tundras were inhabited by the same birds, and we discovered also two or three additional species. One of the party shot an old-squaw duck and an eider, while Dr. Fisher and Mr. Fuertes secured specimens of the exquisite little Sabine's gull — a small species with white plumage, slaty-black hood, a mantle of slaty-blue, and a forked tail. On the tundras of both islands the Pribilof sandpiper was very common and on Hall Island Dr. Grinnell discovered its nest and eggs. It is a fine, large species with a reddish back, a black patch on its breast, and dusky spots on its cheeks. Upon alighting beside a pool it has a characteristic habit of holding one wing straight up in the air for a moment as if to steady the body after the momentum of flight.

Upon leaving St. Matthew Island we proceeded rapidly on our homeward way, and from that time on learned nothing of striking interest concerning the birds. Shortly after leaving Unalaska Island we observed a vast swarm of Pacific fulmars in dark plumage flying about the surface of the water. They must have numbered several thousand birds in one compact flock and were evidently attracted by a school of fish.

Louis A Fuertes.

A. HOEN & CO. BALTIMORE

SABINE GULL, XEMA SABINI

St. Matthew Island, July 15, 1899.

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FORESTS OF ALASKA

BY B. E. FERNOW

LASKA furnishes a field of unusual interest to the student of forest distribution, and it may be worth while to describe and discuss, from both phytographic and economic points of view, the forest conditions of the Territory.

Alaska may be divided into at least five regions, two forested and three forestless, corresponding to climatic and physical conditions.

A true forest country is found only along the southern coast, on the islands of the Alexander Archipelago, and in the panhandle of mainland separating the British possessions from the ocean — a northward extension of the Pacific coast forest. Here the evenly tempered climate gives rise to forest-covered slopes out of which only the higher elevations with their covering of eternal snow reach above timber-line.

Separated from this coast by the high sierra of the St. Elias and Fairweather coast ranges, and by mountain ranges farther inland to the north and west, is the great interior basin drained by the Yukon River, with its hills, mountains, and plateaus, which, while in the main an open country, is studded with more or less frequent islands of forest growth varying in density and development. The

interesting fact to the plant geographer is that the forest flora of this interior region is entirely different from that of the coast region, being in its species essentially the same as our northeastern Atlantic boreal flora.

Intervening between the Pacific and Atlantic forest flora, is the high, somewhat triangular-shaped plateau, enclosed by the coast ranges and the more northern mountains, some 15,000 square miles in extent according to I. C. Russell,[1] a region of absolute, stern, silent, motionless winter, covered with snow and ice all the year round, without a vestige of life.

Again, skirting the coast of Bering Sea from Kuskokwim Bay northward and along the Arctic Ocean, is the tundra — a belt of treeless country, though not entirely devoid of woody vegetation, varying from a hundred miles or less to several hundred miles in width.

Lastly we recognize as a different type the forestless region of grassy slopes and snow covered peaks which the Alaska Peninsula and the Aleutian and other islands west of the 153d degree of longitude exhibit.

To explain this distribution of the arborescent flora, both climatic and physiographic conditions must be adduced. It is easily understood that the mechanical barrier which the ice- and snow-bound mountain ranges interpose should effectively separate the Pacific and Atlantic forest flora. But to the westward toward the Alaska Peninsula and the Aleutian and other islands no such mechanical barrier exists, hence other causes must be found to explain the limits of distribution.

The separation of the coast and interior floras seems in general complete, although an exchange of species may occur here and there across the mountain passes and along the river courses. Thus, a paper-barked birch appears in numbers at the head of Lynn Canal, 1,000 feet

[1] Am. Journal of Science, 3d series, Vol. XLIII, p. 171, 1892.

PHOTOGRAPH BY CURTIS

JOHN ANDREW & SON

ENTRANCE TO WRANGELL NARROWS

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above sea level, and again at the head of Cook Inlet, where the traders state that birch canoes are used by the Indians on Knik River, without its apparent existence in intermediate localities. This distribution would indicate a species from the interior that has crossed the range.

The associated occurrence of the eastern *Populus balsamifera* with its western congener, *Populus trichocarpa* (if indeed the two species can be separated), reported by the late Dr. G. M. Dawson from the Pelly and Lewes Rivers, and observed by us on Kadiak Island, is an example of this interchange, and *Pinus contorta* (or *murrayana*) reported by Dall at the confluence of the above named rivers, furnishes another instance of wandering.

The greatest interest in regard to this approach or interchange of the two floras would center in the region around Iliamna Lake, at the base of the Alaska Peninsula. Here the Pacific coast flora finds its western terminus, and the interior or Atlantic forest flora descends along the Mulchatna and Nushagak Rivers almost to the very shores of Bering Sea, while the low passes between Cook Inlet and Lakes Clark and Iliamna should favor transmigration of the two floras, unless other impediments bar their progress.

While in a general way temperature and moisture conditions are certainly the most influential factors determining the distribution of life groups, it must be evident that with tree growth, combinations of these with factors other than those which determine the distribution of annual and perennial low growths, must be potent. The winter rest in the seed, and the short cycle of development in a single season, characteristic of the annuals; the partial death in winter, and the low stature of the perennials, warmly covered by the winter snows and pro-

tected against variations of atmospheric conditions, give an advantage to these forms of life in northern regions which is lacking in the arborescent flora, with its persistent growth, its long period of life before maturity is reached, and elevation above the ground.

The wintry blasts which are of no moment to the herbaceous plants and shrubs, must be endured by the arborescent flora ; and late frosts in the spring, which may find the former in condition for withstanding their blight, will nip the tree buds which an early warm spring sun has called into premature activity.

Again, while the herbaceous plant readily survives an extraordinarily unfavorable season, and with its prolific annual seed production soon recovers lost ground, the tree individual, after having weathered many winters, may fall a prey to a single exceptional season; moreover, seed production in the tree, coming only late in life and at longer or shorter intervals, is less favorable to reestablishment.

Again, while the low vegetation is able to subsist on a modicum of soil, the tree, as it grows in height, requires corresponding root space, both to supply itself with water and to brace itself against the winds — the leverage increasing with the growth. Soil conditions in the competition between different forms of vegetation may become so important that climatic conditions are of secondary moment; thus we find grass and weeds successfully keeping out the arborescent flora where no climatic impediments to the latter exist.

The combination of conditions influencing forest growth is then, it must be admitted, more complex than that which determines the distribution of smaller plants, and hence not only does the composition of the forest vary according to the adaptability of the species, but at the same time the individual development and density of stand vary with the different conditions.

LUPINES ON WOOD ISLAND

WOOD ISLAND, NEAR KADIAK

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These general considerations will assist in understanding the variety and changes in appearance of the Alaska forest flora.

THE INTERIOR FOREST.

The interior of Alaska is but little known, and as a rule only along the river courses. A few cross-country routes have been traversed by explorers who, not being botanists, leave us in doubt as to the exact species represented in their casual remarks on the forest conditions. They generally mention spruce as the only conifer, and cottonwood, aspen, birch, willow, and alder, as the deciduous-leaved species. The reference to fir and hemlock, as occurring in the Yukon district, made by W. C. Greenfield in the Census volume of 1890, is probably an error. So probably is Dr. C. W. Hayes[1] in error, when, in contrasting the vegetation of the Yukon with that of the coast, he says: "This contrast consists more in the amount of vegetation than in the difference of species."

The account in the ninth volume of the Tenth Census of the 'Northern Forest of the Pacific Region' (p. 7) is extremely vague, and in the light of newer information, faulty; but it attempts at least to designate the species found. The statement is as follows:

"The white spruce,[2] the most important and most northern species of the North Atlantic region, is here also the most important species. It attains a considerable size as far north as the sixty-fifth degree, forming in the valley of the Yukon, forests of no little local importance. The canoe-birch,[3] the balsam poplar,[4] and the aspen,[5] familiar

[1] Nat. Geog. Mag., Vol. IV., p. 136, 1892.
[2] Picea canadensis (Mill.) B.S.P.
[3] Betula papyrifera Marsh.
[4] Populus balsamifera Linn.
[5] Populus tremuloides Michx.

trees of the North Atlantic region, also occur here. The gray pine and the balsam fir of the Atlantic region are replaced by allied forms of the same genera. The larch alone, of the denizens of the extreme northern forest of the Atlantic coast, finds no congener here in the northern Pacific forest."

These determinations of species we may accept for the spruce, birch, poplar and aspen of the interior forest flora of Alaska, but the occurrence of pine and fir seems very doubtful, although *Pinus contorta* approaches the boundary from the British possessions, and *Abies lasiocarpa* was found at the top of White Pass and may be found at timber-line elsewhere in the interior.

From the accounts of all explorers, it appears that the interior is in general an open plateau, hill, and mountain country, mostly moss-covered and devoid of trees; but with scattered more or less open groves on the lower hill slopes and ridges, and in some of the valleys (White River basin[1]), the trees usually crowding together more densely along the banks of rivers and lakes and covering with dense thickets the many islands in the rivers. In some localities the heads of all the streams are surrounded by timber; Lieut. Henry T. Allen reports that his camp on the Tozikakat River[1] "was in a grove of larger timber than any seen since leaving the Yukon; one tree was nearly two feet in diameter"; and at another place he mentions the use of a spruce for a bridge over a river forty feet in width.

While the trees are mostly short, poorly developed, dwarfed, and standing in open positions, in consequence of which the timber is knotty and checked by frost, these groves occasionally assume a real forest character and contain trees developed to good size. Local conditions of soil, and of shelter from the winds, seem to be largely

[1] Allen: Reconnaissance in Alaska, 1887.

influential in this difference of development. The following statement is from the Eleventh Census:

"The whole Nushagak River valley, including Tikchik River and Lake, is densely wooded with trees not more than a foot in diameter, until the distance from the coast and intervening natural obstacles protect the vegetation from the blighting ice-laden Siberian storms, which, though not so low in temperature as the interior blizzards, are yet by far more dangerous, on account of their humidity, to animal and vegetable life. Then the diameter of the trees and the density of the primeval forest increase rapidly, so that on the Mulchatna and the Kokhtuli (Forest) Rivers exceptionally large trees may be found in number. On my last winter's exploring journey I measured in a Kokhtuli spruce grove nine trees, each of which was over three feet in diameter."[1]

In Norton Bay, within a quarter of a mile of the sea, groves of spruce grow thickly, but the height of the trees never exceeds forty feet, and the diameter from six to ten inches; and along the banks of the Tanana River Lieutenant Allen reports that most of the spruce range from three to eight inches in diameter. This dwarfed condition may in some parts be accounted for by altitude.

In mountainous parts, as is well known, dwarfed trees occur at high elevations. In this connection it is interesting to note that the altitude of timber-line is higher in the interior than on the coast. On the coast it varies from 1,800 to 2,400 feet, while in the interior it has been found as high as 4,000 feet. And even in latitude 68° N., J. H. Turner,[2] who made a journey northward along the boundary line from Rampart House on Porcupine River, found, at an altitude of 2,500 feet and "extending eastward to the furthest horizon, a plain, covered with a dense growth of

[1] Eleventh Census: Population and Resources of Alaska, p. 92, 1893.
[2] National Geographic Magazine, Vol. IV, p. 196, 1893.

spruce, birch, and cottonwood — a veritable oasis in the midst of utter desolation."

While certain mountains may limit the southern boundary of this interior forest region, the western limit of tree growth follows a line between the 161st and 163d degrees of longitude, from Nushagak River to Golofnin Bay in Norton Sound, then turning northeasterly to the Keewalik River and the hills to the west of Noatak River and (at about the 67th degree of latitude) changing to eastward and following the watershed of the Kowak River to its headwaters, when it assumes the northeasterly direction of the Endicott Mountains along the watershed of the Colville River to the low mountain ranges which skirt the Arctic Ocean within twenty-five miles of the coast, as far east as the Mackenzie River, where, between the 69th and 70th degrees of north latitude, the northernmost tree growth occurs. Timber is said to abound on the dividing ridges of the interior, between Colville River and the British possessions.[1]

The open and stunted character of the tree growth, which is so general, may be in part a result of the comparatively dry climate — for this region, while blessed with an abundant snowfall (eight to fifteen feet), suffers from droughty summers (rainfall about thirteen inches). In summer the temperature is said to exceed 112° Fahr. in the shade, while in winter it has been known to fall to — 60° and lower, a range of over 170 degrees. The distribution of forest areas is probably also largely influenced by soil or drainage conditions: "The entire face of the country is covered with a heavy growth of moss and lichens, nearly as thoroughly saturated as a wet sponge, which remains soggy and cold until late into summer, and even on slopes the water drains off but slowly, while a

[1] H. D. Woolfe, in Eleventh Census: Population and resources of Alaska, p. 134, 1893.

SCRUB PINE IN BOG NEAR WRANGELL

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few inches below this cover is a bed of rock or ice or frozen ground which thaws only for a foot or two in summer and prevents the water from sinking." The opportunities for tree seeds to sprout are, therefore, found only here and there on the better drained slopes and on the alluvial sands of river bottoms and islands.

The lowlands which skirt Bering Sea and the Arctic Ocean exhibit this inimical condition of soil, which is sufficient to explain the absence of tree growth; but here additional causes may be found in the absence of protection from the icy winter blasts, and perhaps in a deficiency of summer rains, for, although the atmosphere is humid, the low tundras furnish no causes for condensation.

The peculiarity which seems in general to characterize the Arctic flora, namely, the appearance of species in groups or islands, attaches also to the forest cover, for the forest is not always mixed, but groves of one species by itself are frequent. Numerically the spruce would appear the commonest, the birch the rarest tree.

The economic importance of these limited forest areas is growing with the development of the mining industry. Not only must the scanty resources be drawn upon for fuel to keep the houses warm, and to run the steamboats and machinery, but the advantageous working of the placers requires the use of fire in thawing the frozen ground. Yet the usual carelessness and recklessness which characterize pioneering has already shown itself in the destruction of considerable areas by fire. It is said that around Lake Lindeman, nearly all the timber is burned off, none suitable for boat building being left.

Lieutenant Allen reports burnt spruce in various localities and speaks of the "heavy smoke caused by the extensive timber fires which obscured the sun the entire day." In this case it was the signal fires of the Indians which were the cause.

THE COAST FOREST.

Entirely different in composition, manner of distribution, and development is the coast forest — a result of the widely different character of the climate it enjoys.

This forest is an extension of the coast forest of Washington and British Columbia, but as it pushes northward it gradually loses some of its species and deteriorates in individual development. It covers the many islands of the Alexander Archipelago and the panhandle along the main coast as far as the head of Lynn Canal (only the steeper and higher slopes remaining bare) and skirts the shore from Cape Spencer westward with a narrow belt, rarely over ten miles in width, along the foot of the snowy Fairweather and Mount St. Elias ranges, following up the valley of the Copper River, surrounding the shores of Prince William Sound and Cook Inlet, covering Afognak, Spruce, and other neighboring islands, and coming to a rather abrupt termination on the north shore of Kadiak Island. Here groves of spruce are restricted to the lower shore lands and sheltered localities. Ugak Bay on the east, and Cape Uganuk on the west side of the island, are the farthest western and southern points of forest growth. Similar groves in similar situations occur on the Alaska Peninsula around Kukak Bay.

There is some evidence that this western limit is not, or may not remain, stable — that the spruce has wandered in recent times, and may still wander. There is also evidence that the treeless country beyond, made up of the Alaska Peninsula and Aleutian Islands, is not incapable of growing trees.

An interesting evidence of the progress of the spruce may be seen on Long Island, a few miles east of Kadiak, where an extensive spruce grove has established itself within the last century. Many trees had been freshly cut,

PHOTOGRAPH BY GILBERT JOHN ANDREW & SON

East Coast of Vancouver Island

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and a count of the rings showed none older than ninety or a hundred years, while on Kadiak and Wood Islands the oldest growth was found to be between 125 and 150 years, with some few rotten stumps possibly older. This difference in age of entire groves so near together allows the inference that the older has furnished the seed for the younger, and that the spruce has wandered from Kadiak to Long Island.

This suggests another influential factor in the distribution of trees, namely the winds as carriers of seed: not only the direction of the wind but the character of the weather accompanying it influence this distribution. In wet weather the cones close; it is only in dry weather that they open and release the seed. To secure the southwest extension of trees along the Alaska Peninsula, it would be necessary that, after the ripening of the seeds and during their release from the cones, which takes place gradually through the winter, the winds should be dry and blow from the north and east. But the contrary usually happens, for from September to May there is a constant succession of southeast and south winds, and the air is heavily charged with moisture. For this reason the spread of the species is at least retarded, and only when, as may occasionally happen, favorable wind direction at the right time coincides with a seed year, is progress possible. That seed production as far west as Kadiak can be most prolific was evidenced by an enormous crop of cones which ripened in 1898, turned brown, and remaining on the branches in the summer of 1899, gave the trees at a distance the appearance of having been killed by fire. How much of this seed is good and capable of germination, and how often seed years occur could not be ascertained.

That trees can at least exist farther west, on the Aleutian Islands, is proved by a few scattered spruces at Unalaska, planted by a Russian priest in the year 1805.

One group of twelve and another of seven remain; the trees are short and slowly grown, to be sure, but vigorous and in good health, except where fire has damaged some of them. At the time of our visit the largest measured twenty-four inches, the smallest, six inches in diameter, while all were of the same height, twenty-five to thirty feet. The trees had been fruiting heavily the year before, and two smaller ones at a distance were undoubtedly the result of an earlier seed year. Evidently the chances of natural propagation in competition with the heavy growth of grass and weeds, with a late spring, short summer, and cold winds are small, even if ample sources of seed supply were within reach.

The even tempered, moist climate which the islands of the Alexander Archipelago and the western and southern coasts enjoy, accounts for their luxuriant forest cover of conifers. Luxuriance, however, is a relative term, for while undoubtedly the vegetation, including the undershrubs and moss which cover the ground, is rank, the development of the trees, as we shall see further on, is by no means comparable with the matchless growth around Puget Sound, nor is the variety of species as great.

The Alaska forest lacks the most important timber of the Pacific coast, the red fir or Douglas spruce (*Pseudotsuga taxifolia*) whose northernmost specimens were observed on Princess Royal Island. It lacks the pines, with the exception of the inferior *Pinus contorta*, which here and there occupies swampy and dry, gravelly situations. None of the magnificent firs of the Sierra and Coast ranges are to be met, the northernmost specimens of *Abies amabilis*, usually a tree of high elevations, being found on Lowe Inlet, at the very shore, though still in superior form. The small *Abies lasiocarpa* in dwarfed specimens, remains the only timber-line tree at White Pass, which it has reached, perhaps, from the interior.

"The Forest," Unalaska.

(Only trees on Aleutian Islands are at Unalaska.
These were planted early in the Century.)

PHOTOGRAPHS BY CURTIS

JOHN ANDREW & SON

Trees on Kadiak Island

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The giant arborvitæ or red cedar (*Thuja plicata*), to be sure, enters this territory, but only in small numbers, and is soon lost, not occurring farther north than Prince of Wales Island, although on the inside passage it was observed at Wrangell.

The Alaska or yellow cedar (*Chamaecyparis nootkatensis*), which in Sargent's Silva is reported not farther west than Yakutat Bay, appears to exist in a few isolated localities on Prince William Sound. The stations were not actually visited, but evidence of their existence was found in the wood and bark used in buildings of an Aleut village at the foot of Copper Mountain, and also in the information furnished by traders that limited numbers of this species are to be found on Hawkins Island, six or seven miles from Orca, on Glacier Island, opposite Columbia Glacier, and in a few other confined localities. This tree, although deriving its name from the country, is really only sparingly represented in localized aggregations or clumps, occupying especially southern mountain slopes from the shore to the very tops. It furnishes the beautiful, fine-grained, yellow-tinted wood which the Indians use for their carvings, totem poles, paddles, and so on. The Oregon alder (*Alnus oregona*) was found abundantly as far as the foot of La Perouse Glacier, a little south of Mt. Fairweather, but was entirely absent at Yakutat Bay and farther west.

Excepting, then, the more or less sporadic occurrence of species mentioned, the composition of the forest is simple indeed, for the bulk is made up of a mixture of two species, the tideland or Sitka spruce (*Picea sitchensis*) and the coast hemlock (*Tsuga heterophylla*), to which may be added, near timber-line and farther west on the lower levels, the interesting and beautiful Alpine hemlock (*Tsuga mertensiana*).

Numerically, the coast hemlock seems to be the most

common species, forming usually from 70 to 80 percent of the mixture, the spruce only occasionally preponderating, especially along water courses and on newly forested moraines, until the western limit of the hemlock is reached at Prince William Sound. Even here the hemlock remains a prominent component. Farther west, however, the spruce alone continues to form forests or open groves, as on the shores of Cook Inlet and Kadiak Island.

This sombre mixed forest of hemlock and spruce covers with a more or less dense stand the slopes of the mountainous islands and the shores of the Archipelago up to timber-line, which varies from 1,800 to 2,400 feet near the shore, but towards the interior gradually ascends with the snow-line in protected inland passes, like Taku Pass, to over 5,000 feet.[1]

FOREST NEAR SITKA.

The stand is usually not so dense as would be desirable to make the clean, long boles which furnish the best logs. Indeed, while individual development reminds us occasionally of the giants of the Puget Sound country, while spruces six feet in diameter and 175 feet in height were found at Sitka, and while even as far west as Prince William Sound diameters of over five feet with heights of 150 feet were measured, the branchy trunks offer little inducement to the lumberman. Only in some favored situations

[1] C. W. Hayes, in National Geographic Magazine, Vol. IV, p. 137, 1892.

PHOTOGRAPH BY CURTIS

JOHN ANDREW & SON

INDIAN RIVER

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is the growth denser, the boles less tapering and cleaner of branches, and less knotty.

This generally undesirable development, due to open stand, is probably caused less by climate than by soil. The soil overlying the rocks of the rugged slopes is scanty, and becomes more and more so as we go north, until finally only the muck of decayed moss and other vegetation furnishes a foothold for the trees. In consequence, fallen timber frequently makes travel impossible.

The underbrush and lower vegetation is often dense and luxuriant, comprising species of *Vaccinium*, *Rubus*, *Ribes*, *Menziesia* and the spiny *Echinopanax horridum*, which was found as far north as Point Gustavus in Glacier Bay. A heavy cover of moss hides the mucky soil, which is wet probably all the year.

Now and then swamps occur, which, so far as tree growth is concerned, show only dwarfed specimens of *Pinus contorta*, or possibly of hemlocks. Along the shores and in the river bottoms deciduous trees and shrubs relieve the monotony of the evergreens, among which occasional clumps of *Pyrus rivularis*, *Sambucus pubens*, *Sorbus sambucifolia*, and *Viburnum pauciflorum* and in the lower latitudes Oregon alder are observed. Cottonwoods (*Populus trichocarpa* and *balsamifera*) form groves on the flats as far west as Kadiak Island, and willows, shrubby and in tree form (*Salix sitchensis* and *alaxensis*), fringe the water courses; and whatever other space is left open, high or low, wet or dry, is at once occupied by the ubiquitous shrubby alder (*Alnus sinuata*) with its many stout stems forming impenetrable thickets.

One of the most interesting examples of the evolution of a forest growth in progress, which the writer had the opportunity to study, was found in Glacier Bay. The peninsula known as Point Gustavus which juts out from

the mainland about twenty miles below Muir Glacier is formed by the moraines of the receding glacier, old enough to be diversified into a maze of hills and valleys, the top varying from dry, coarse gravel to pure sand and finer silt towards the point. The interior portions, mostly in the nature of sand dunes cut through by low, swampy places and occasional clear rivulets, are more or less without vegetation, at least without forest growth, except on the compacter gravels, where *Pinus contorta* has established itself in open growth.

Along the shores, however, is a belt of varying width, consisting of a dense growth of spruce with an occasional and poorly developed hemlock (*Tsuga heterophylla*) or balsam poplar, while the shrubby alder and willows occupy ravines and draws, and line the skirts of the spruce forest. The soil under the spruces is densely covered with a heavy carpet of mosses among which three or four species are prominent, with the pretty *Listera*, the constant companion of the shady spruce, and a *Pyrola* which grows in the darkest corners, while a *Vaccinium* and the brake (*Pteris aquilina*) occupy the more open places. Besides these, species of *Ribes*, *Viburnum*, *Sambucus*, *Streptopus*, *Lycopodium*, *Aruncus*, and the prickly *Echinopanax* are present.

This spruce forest, as can be readily ascertained by counting the internodes and the annual rings of a few cut trees, is all between forty and fifty years old. The largest trees are as much as thirty-six inches in diameter and eighty feet in height, showing the remarkable rapidity of growth which characterizes the tideland spruce.

The history of the evolution of this forest and of the recovery of the ground by vegetation is written in clear language. First the rough gravel of the moraine was colonized by the prostrate willows and the *Equisetum* and *Epilobium* that grow on the moraine in front of

PHOTOGRAPH BY CURTIS

RESURRECTED FOREST NEAR MUIR GLACIER

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Muir Glacier; with these soon appeared the ubiquitous shrubby alder (*Alnus sinuata*) and the feather-seeded balm of Gilead, which, as they grew in height, crowded out the light-needing willows; then, some forty or fifty years ago, a good seed year occurred in some neighboring forest on the mainland, together with favorable wind conditions, and at least the margin of the thicket of alders and cottonwoods was sown to spruce. This shade-enduring, yet rapid-growing and persistent species soon attained the height of the low alders and shut in and finally killed the light-needing cottonwoods, leaving only their dead and decaying stumps and trunks as witnesses of their former occupancy of the soil. Here and there a cottonwood has persisted with its crown still in the sunlight — a tall, slender pole, clean of branches — showing in the narrow rings of the last years' growth that it is doomed soon to succumb to its stronger neighbor.

Meanwhile, this fringe of spruces forms an effectual barrier to the dissemination of seeds in the interior from outside sources and the light-needing species already there will remain in undisturbed possession until the spruces of the Point itself begin to bear seed freely; finally, however, they must succumb to the more persistent and shade-enduring spruce and hemlock, except where soil conditions are too unfavorable for these species. Yet, after their dominion is established, should the glacier again advance, the same catastrophe may overcome the victors as is revealed near Muir Glacier, in the uncovering of a buried forest, established uncounted ages ago at a different stage of glacial development — a catastrophe, the possibility of which is exemplified in many places, where the push moraines are crowding upon the forest.

Of the many other interesting observations on local distribution and the relation of tree growth to soil, only two may be noted. The first refers to the presence of trees

in close proximity to some of the great glaciers, showing an astonishing indifference to the influence of the near-by ice masses. Not only do the trees, wherever soil conditions permit, grow close to the icy river, attaining (as a measurement within one hundred yards of LaPerouse Glacier showed) diameters of five feet and heights of 150 feet, but in places they even encroach upon the icy field, when this has come to rest and has a scanty cover of soil from the moraine material, upon which vegetation can establish itself. Thus, at the foot of Lucia Glacier, on Yakutat Bay, the stream which runs in a wild torrent from the glacier has cut a veritable canyon[1] through the ice, exposing an ice bank over one hundred feet in height. This ice is overlaid with moraine material a foot or more in depth, and this is sufficient to support a dense cover, not only of herbaceous, but of woody vegetation — a thicket of the ever-present alder, with occasional willows; and even spruces do not find the substratum too cold. As the ice melts at the border, the soil and its occupants may be seen from time to time tumbling down into the stream, or else into the deep potholes with which we find this ice plateau amply provided.

The other observation which I desire to record refers to an example of the substitution of soil conditions for climatic conditions.

The beautiful Alpine hemlock (*Tsuga mertensiana*), the embodiment of unyielding perseverance, is *par excellence* the tree at timber-line throughout the Cascade and Sierra Nevada ranges; we do not expect to find it except in the humid-cold atmosphere of high elevations, battling with the storms in ice and snow. That single specimens should occasionally find their way down among the vegetation of lower levels, as at Hot Springs, near Sitka, does

[1] See I. C. Russell's full description in National Geographic Magazine, Vol. III, pp. 176–185, 1891.

PHOTOGRAPH BY CURTIS

FOREST OVERTURNED BY COLUMBIA GLACIER

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not astonish us; but when, as in Prince William Sound, it becomes, as observed in some localities, the prominent tree at the seashore, supplanting the coast hemlock, we look for an explanation other than accident, especially as the coast hemlock is by no means absent from the slopes, nor the Alpine hemlock from the timber limit, which is here above 2,200 feet. At Gladhough Bay as usual the typical spruce and coast hemlock forest covers the slopes, and at the timber-line, as usual, the Alpine hemlock first supplants the coast hemlock and then becomes sole ruler. But at the base, near the seashore, is found an interesting feature in the openings occupied by sloping bogs, in which the water stands in pools and only slowly drains through the heavy moss and grass cover to the sea level. The character of this ground may appear from the enumeration of a few of the most common plants: among *Carices*, *Juncus*, and *Equisetum* we find *Menyanthes trifoliata* and *cristagalli*, *Geum calthiflorum*, and *Phyllodoce glanduliflora*, besides *Drosera*, *Iris*, *Dodecatheon*, and *Myrica gale*, the latter being the most common shrub.

In this wet, cold soil, the Alpine hemlock evidently has an advantage over its congener, which, although not entirely absent, shows in its development its antipathy to this kind of feeding ground.

ECONOMIC ASPECTS.

This forest of Alaska has often been referred to as a great resource of wood materials, on which the people of the United States could fall back when the virgin supplies of the home country might become exhausted, and glowing accounts of the magnificence of this reserve have been given. As has been pointed out, this forest growth occupies a considerable area, probably not less than twenty to thirty thousand square miles, but it is of a character which makes the prospect of reliance upon its stores by no means

cheerful; for, while in certain favored spots good enough material can be secured, most of this material is not of a superior quality, and the larger portion of the area does not contain trees fit for lumber.

Leaving out of consideration the two cedars, which are found only in limited quantities and will soon be exhausted, the other two species, spruce and hemlock, are, by their nature, not capable of furnishing high class lumber. The hemlock furnishes a material which would answer very well for house-finishing purposes, but it is objected to because it is difficult to work and has the bad reputation of its eastern congener, which the writer believes it does not deserve. Enormous quantities, too, of far superior development are now going to waste in the forests around Puget Sound, because its value is not known or appreciated in the market. The spruce, being a rapidly-grown, coarse-grained wood, even where it is best developed on the Oregon coast, makes indifferent lumber, fit only for packing cases, boxes, and common building material, undesirable as long as better material can be had.

In addition to the small value of these woods and their comparatively unsatisfactory development, the conditions under which lumbering on the rugged slopes would have to be carried on are extremely difficult; add to these detractions the distance from market, and we may readily see the reasons why this reserve will, for an indefinite time, be left untouched except for local use.

So unfavorable is the combination of conditions, natural and economic, at present, that it pays to import lumber from the Puget Sound country or other points of the lower coast. The builders of the Yukon and White Pass railroad across White Pass found it to their advantage to import the railroad ties, as well as all trestle and bridge timbers, although the road passes through a forested country; and even the timber used in the cannery establishment at Orca,

Painting by Walpole

Heliotype Co

NARCISSUS BUTTERCUP

Ranuncalus cooleyae Vasey and Rose.

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on Prince William Sound, as well as for other such establishments, is brought by vessel, a sawmill established in the neighborhood being unable to compete. There are, nevertheless, a number of sawmills at intervals along the coast supplying local needs, notably at Sitka, Metlakahtla, Wrangell, and Douglas City.

That the value of this forest resource must increase with the development of the country and with the increase of local needs allows of no doubt; as a field of exploitation under present economic conditions, however, it does not, in the belief of the writer, offer any inducements, unless it be that the spruce could be turned into paper pulp, a good felting fiber being probably insured by the rapid growth which is found at least in the Archipelago. Farther north and west the rate of growth diminishes considerably. In various localities a few measurements were made, which will exhibit the rate of growth.

At Sitka, several large spruce trees, freshly felled, showed a height of 175 feet and a diameter of 6 feet, with ages varying between 400 and 500 years.

At Prince William Sound, a number of logs gave the following measurements:

50	annual	rings,	11 inches,
72	"	"	12 to 15 inches,
80	"	"	20 inches,
125	"	"	22 inches,

which would indicate a rate of about five years to the inch of diameter, a rather slow growth for this species.

At Kadiak, at the western limit of tree growth, the rate appeared more rapid; the heights, to be sure, were reduced, but the diameters still made a very fair showing, although variations in width of annual rings greater than usual with trees grown in such open position were apparent. Trees 50 to 60 years old showed diameters of 12 to 15 inches and

heights of 45 to 55 feet; trees 70 to 90 years old exhibited diameters of 18 to 27 inches; trees 100 to 150 years old varied between 20 and 36 inches and showed heights up to 120 feet. The largest trees found, without chance of ascertaining their age, were 45 inches in diameter and 120 feet in height.

From natural dangers these forests do not appear to suffer much. Of insect damage little was noticed. The humidity of the atmosphere and soil furnishes, no doubt, considerable protection against fire, the greatest enemy of the American forests; nevertheless, there are evidences that it cannot be kept out entirely. Avalanches, here and there, have ploughed through the forest slopes to the water's edge, and the hot ashes of Iliamna Volcano, near Cook Inlet, are credited with the destruction of a considerable area of spruce forest.

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Painting by R. Swain Gifford

Pub. Taber-Prang Art Co.

MT COOK FROM YAKUTAT BAY.
Alitude [illegible] ft

GENERAL GEOGRAPHY

BY HENRY GANNETT

LASKA, our northernmost possession, extends over more than 20 degrees of latitude and 45 degrees of longitude — as far as from Florida to Maine and from Maine to Utah.[1] From the main body of the territory stretch two projections, one to the southeast, comprising the Alexander Archipelago and the adjacent mainland, the other to the southwest, comprising the Alaska Peninsula and the Aleutian Islands.

The exact area of Alaska cannot at present be known, owing to the fact that the boundaries are as yet located only approximately. The seacoast, which forms by far the greater part of the boundary, has not been accurately mapped, except in small part, while the land boundary on the southeast, which separates our territory from Canada, has not been defined, except in the general terms of the treaty of cession from Russia. Various measurements have been made, based upon different maps, giving areas ranging from 570,000 to 600,000 square miles. A careful recent measurement from the large map published

[1] It lies between latitudes 51° and 71° 30′, extending 5 degrees within the Arctic Circle, and stretches from longitude 130° to 175°. The great body of the territory lies, however, between latitudes 60° and 71° 30′, and between longitudes 141° and 168°.

by the U. S. Coast and Geodetic Survey (scale 1:1,200,000) gives its area as 590,884 square miles. Of this the portion lying east of the 141st meridian, popularly known as southeastern Alaska, which is the best known part of the territory, has an area of 43,710 square miles, of which 30,800 square miles consist of mainland and 12,910 square miles of islands, forming what is known as the Alexander Archipelago.

The Cordillera of North America enters Alaska at its southeastern extremity and follows the Pacific coast around to the Aleutian Islands. Beyond this mountain system, and following its general trend, is a broad depression, drained by the Yukon River and its tributaries. North of this basin is a height of land which separates the Yukon valley from the bleak shores of the Arctic Ocean.

THE PACIFIC COAST REGION.

This portion of the territory is mountainous throughout. Although the coast of the mainland and of the islands is, all together, several thousand miles in length, yet for the entire distance there are very few square miles of level ground. The land rises from the water almost everywhere at steep angles, without a sign of beach, to altitudes of thousands of feet. It is a fiord coast. The islands are separated from one another and from the mainland by fiords, deep gorges whose bottoms are in some cases thousands of feet below the surface of the water. These fiords extend far up into the mainland and into the islands, in deep, narrow U-shaped inlets.

The relief features of this region, its mountains and its gorges partly filled by the sea, are all of glacial origin, presenting everywhere the familiar handwriting of ice. Every canyon, every water passage, whether called strait, canal, or bay, is a U-shaped gorge, and its branches are similar gorges, commonly at higher levels — 'hanging

PHOTOGRAPH BY CURTIS JOHN ANDREW & SON

A "Hanging Valley," Frazer Reach.

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valleys' they have been called. Above the cliffs of the gorges the mountains rise by gentle slopes to the base of the peaks. The cross profile of each gorge and its surroundings is that of ice, not of water carving. It is the work of channel erosion, not of valley erosion, and the channels were filled with ice. It is a colossal exhibition of the eroding power of water in solid form. From Lynn Canal, a fiord ninety miles in length, there have been carried off and dumped into the Pacific more than 200 cubic miles of rock, and from all the fiords of southeastern Alaska the amount removed may be safely estimated at thousands of cubic miles. The ice has but recently retreated from these gorges, for since its retreat water has done but little work, although the region is one of heavy rainfall and extremely steep slopes, where aqueous erosion is at a maximum.

Of the great glaciers which occupied this region a short time ago, only trifling fragments remain in the upper ends of the gorges, and comparatively few now reach the sea. I use the word trifling, however, merely in relation to their former extent, for absolutely these remnants are not at all trifling. The ice cap of Greenland and the glaciers of the Antarctic continent alone exceed them in magnitude. All the glaciers of Switzerland together would form but a few rivulets of ice on the surface of the great Muir Glacier, and the Muir is but one of many glaciers of equal magnitude. Indeed, on this coast are scores of live glaciers, glaciers which reach the sea, presenting to it fronts of ice or ice walls rising from the sea bottom to 200 or 300 feet above its surface, and several miles in length, and which drop bergs, with thundering sound, into the sea. Of such glaciers about thirty were visited by the Harriman Expedition, and others are known. Of dead glaciers, or those whose fronts do not reach the sea, hundreds are known.

The mountains increase in height toward the northwest, but not at a uniform rate. They culminate near the coast in the Fairweather Range, south of Yakutat Bay, at about 16,000 feet, and in the St. Elias Range, west of Yakutat Bay, at 18,000 feet or more. These ranges are not regular or continuous. While they follow the general direction of the coast, toward the northwest, they are extremely broken, being cut through on the mainland by many fiords and by streams flowing into the heads of the fiords. The Stikine, which reaches the coast near Wrangell, heads far to the eastward, in Canada, and cuts across the entire breadth of the Cordillera system. The same is true of the Taku River, which, flowing through Taku Inlet, reaches the coast near Juneau; and of the Chilkat, which flows into one of the heads of Lynn Canal. Alsek River heads far to the north, in Canada, and cuts a gorge through the great Fairweather Range. These are the main rivers of this coast, but there are many smaller ones, which head either beyond the mountains to the north and east, or far within them.

The coast line from Cross Sound northwestward to Prince William Sound is comparatively smooth and simple, containing no inlet of magnitude, with the exception of Yakutat Bay. As far as Yakutat Bay it is closely bordered by the Fairweather Range, which rises abruptly from 10,000 to 16,000 feet almost from the water's edge, bearing on the summit a succession of peaks and covered with glaciers along both slopes. A day long to be remembered was that on which our ship steamed, between 8 o'clock in the morning and 6 in the afternoon, from Yakutat Bay to Cross Sound, along the entire front of this range, which was outlined against a cloudless sky.

Yakutat Bay is a deep funnel-shaped bay, penetrating far into the heart of the mountain region. At its apparent head it turns sharply upon itself to the south and extends

PHOTOGRAPH BY HARRIMAN

JOHN ANDREW & SON

RUSSELL FIORD

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back nearly to the sea in a narrow fiord, bordered on either side by high mountain walls. This extension, heretofore named Disenchantment Bay, has been rechristened. The story of the locality is as follows: More than a century ago Malaspina, the Spanish navigator, entered Yakutat Bay while in search of the Northwest Passage. Sailing on up the bay and finding that open water extended far inland, he for a time thought that for him had been reserved the fame and satisfaction of discovering the long-sought route through the North American continent. His dream was short, however, for on nearing the bend in the bay he found his way blocked by a solid wall of ice. This ice was the front of the combined Hubbard and Turner glaciers, which then extended far beyond their present limits, completely closing the entrance to the fiord above, which at that time was probably an open lake some 200 feet above the level of the sea, and overflowing southward into the Pacific. In memory of his disappointment, Malaspina named the upper part of Yakutat Bay 'Disenchantment Bay.'

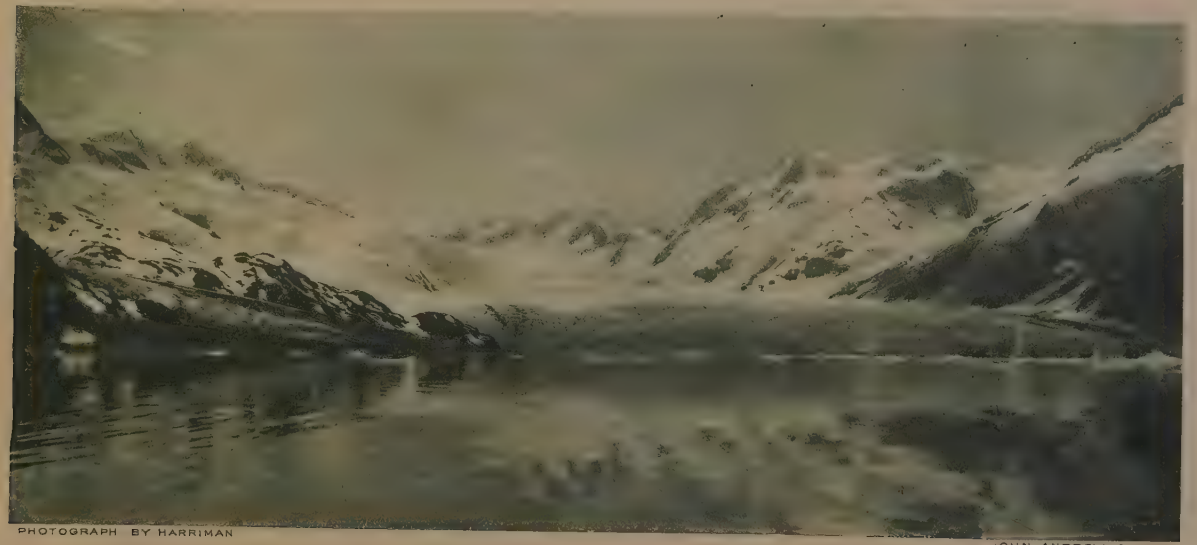
Prof. I. C. Russell, when exploring the head of the bay in 1891, discovered the fiord, and in an open boat traversed it for its entire length. Instead of naming it, he extended the application of the name Disenchantment Bay to cover it. We have rechristened it, in honor of its discoverer and first explorer, Russell Fiord. Our ship, the George W. Elder, was the first large vessel to go to the head of this fiord. We made the passage under the pilotage of a Yakutat Indian and lay at anchor over night at its head.

Northwest of Yakutat Bay for many miles the shore is covered by a field of ice, Malaspina Glacier, which is in the main a stagnant pool, wasting only under the heat of the summer sun, and supplied by ice streams from the St. Elias Alps, which border it on the north and east.

Farther to the northwest stretches a low coast, rising into mountains a score or two of miles inland. Through these mountains flows Copper River, at whose mouth is an enormous delta, built up of detritus which it brings down from the interior.

Then comes Prince William Sound, a bay of irregular shape, with many tentacle-like fiords extending in various directions into the land. Its entrance is nearly closed by islands between which are several navigable passages. The islands near the shores are everywhere mountainous, and on the north shore mountains rise to about 10,000 feet, the higher ones everywhere skirted with glaciers, many of which come down into the sea. Several of the fiords are of great length, reaching far inland. Thus Port Valdez, up which the Copper River route to the interior passes, extends inland more than thirty miles, and Port Wells, on the northwest of Prince William Sound, pushes forty miles into the interior, far up among the high mountains, and each of its branches terminates in a living glacier. Passage Canal, too, up which runs the portage route to Turnagain Arm of Cook Inlet, has a length of thirty miles.

Prince William Sound, in the mountainous character of its shores, in its multitude of islands and fiords, and in the almost total absence of level land, resembles southeastern Alaska. It was, until recently, but little known, all our information concerning it being derived from the explorations of Vancouver and Malaspina, made a century or more ago. Within the past two years, however (1898 and 1899), exploring parties under Captain Abercrombie and Captain Glenn have supplemented the work of Vancouver and Malaspina, and have added materially to our knowledge of the coast and adjacent lands. Some additional information also was gained by the Harriman Expedition, especially concerning Columbia Fiord and Glacier, and of Port Wells and its glaciers, in the form of sketch



PHOTOGRAPH BY HARRIMAN

JOHN ANDREW & SON

HARRIMAN GLACIER
HEAD OF HARRIMAN FIORD

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maps and photographs of these localities. The head of Port Wells and a large branch coming in from the west were explored and mapped. This western branch, shown on the sketch map as Harriman Fiord, was in all probability closed at no very remote time by the front of Barry Glacier, which extended across the fiord to the opposite shore; indeed, until our visit, it was still supposed to be closed. In bringing our ship close to the glacier front to obtain photographs of it, our party discovered the opening between its point and the land, and as we steamed through we saw unfolded before us a magnificent vista of mountain and glacier.

> "We were the first that ever burst
> Into that silent sea."

It was sunset when we entered the portals, and through the long twilight of the Arctic evening, we passed up the fiord with mile-high mountains and great glaciers on either hand. A little before midnight we reached its head, where it is terminated by the front of Harriman Glacier. A surveying party was landed there, and two days were spent in making a reconnaissance of the fiord and its surroundings. In this fiord, in a length of 15 miles, there are, besides a score of 'dead' glaciers, five live glaciers, four of them of the first magnitude, and all reaching the sea and discharging bergs into it.

The general direction of the coast, which trends northwest to a point beyond Mount Saint Elias, gradually swings to the westward, and beyond Prince William Sound turns toward the southwest in the Kenai Peninsula. Beyond the end of this are mountainous islands, Afognak (594 square miles) and Kadiak (3,642 square miles) the latter the largest island in Alaska waters. These continue the line of Kenai Peninsula to the southwest, and are separated by the waters of Cook Inlet and Shelikof Strait

from the Alaska Peninsula. This latter peninsula bears the backbone of the mountain system which follows the coast, the westward extension of the Cordillera. Of its structure little is known, except that here and there are upturned stratified beds and occasional volcanoes, some extinct, others still smoking, as if the internal fires were banked, but not extinguished. Among these are Redoubt, Iliamna, St. Augustine (on an island near the coast), Pavlof and many others. Beyond the west end of the Alaska Peninsula its general direction is continued by groups of islands and islets, as if the mountain range of which it is composed were sunken below the sea and only the summits of its peaks protruded above the waves. These are the Aleutian Islands. Upon them also are many volcanoes, some alive, some dormant.

BERING SEA.

Just north of the Aleutian Islands, which run in a broad curve, convex southward, over ten degrees of longitude, are two islands, Bogoslof and Grewinck. These are very young, the older having come into being 104 years ago, the other being but 17 years of age. Only half a generation ago it rose from the sea, with great fury and turmoil of escaping steam, and although for 17 years its shores have been bathed in the icy waters of Bering Sea and its summit wrapped almost constantly in chilling fogs, it is still hot and gives out steam. Its older brother has long since cooled and is now the nesting place of millions of birds, and the breeding ground of hundreds of sea-lions.

North of these rocks, far in the gloom of the eternal fogs of Bering Sea, lie the Seal Islands or Pribilofs, St. George and St. Paul, little islands of hills and gentle slopes of tundra, clothed in summer with a rich mantle of grass and flowers. Still farther north, in the midst of this dreary sea, where the sun seldom shines, are St. Matthew

PHOTO BY MERRIAM

GILBO

MT. PAVLOF, ALASKA PENINSULA

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and Hall Islands, buttressed by cliffs, above which are undulating slopes of tundra, grassy and gay with flowers; and beyond them St. Lawrence, a mountain island fringed by a boggy plain.

The Alaska coast of Bering Sea is mainly low and marshy, rising very gently inland, and consisting almost entirely of tundra. The Yukon, the great river of Alaska and one of the great rivers of the earth, ends its long journey seaward in an enormous delta, which covers thousands of square miles. Through this great area of low, level land its distributaries meander sluggishly to the sea, bringing from the interior mud and gold and drift-wood, to be spread along the coast by the currents.

Such is the Alaska coast: where it faces the Pacific, bold, rugged, and bordered throughout by a mountain barrier; where it faces Bering Sea, low, tundra-clothed, and affording easy access to the interior by means of its great river.

THE INTERIOR.

Of the interior of Alaska we know much less than of its borders. Not only did the early explorers confine their attention almost entirely to its coasts, but the inhabitants, both natives and Europeans, owing to the difficulties of land travel in the interior, have always lived upon the coast or upon the larger streams, and have made their journeys by the water routes. It is only in recent years that definite geographic information concerning the interior has been obtained, and at present, through the extensive explorations carried on by the U. S. Geological Survey and officers of the U. S. Army, such information is rapidly increasing.

The primary slope of the land is toward the west and southwest, as is indicated by the courses of the great rivers of the Territory, the Yukon, Kuskokwim, Koyukuk, and others. The trend of the mountain uplifts, on the

Pacific side, swings around from northwest to southwest, thus following the general course of the coast. Of the great features of the territory this chain forms the southernmost, and is the key to the structure of the country. Succeeding it on the north is the great valley of the Yukon, which is separated from the Arctic coast by ranges of low mountains and broken country probably nowhere exceeding 5,000 or 6,000 feet in altitude.

The Cordillera attains its greatest breadth and altitude between longitudes 142° and 152°. Here are many summits reputed to exceed 12,000 feet in height, with Mount Wrangell, said to be 17,500 feet, and Mount McKinley,[1] so far as known the highest summit on the North American continent, rising to an altitude of 20,464 feet. In this portion of the mountain system are the sources of many large rivers, the White, a branch of the Yukon, the Copper, well named on account of the enormous deposits of copper ore found near it, the Sushitna, flowing into the head of Cook Inlet, the Tanana, another branch of the Yukon, and finally the Kuskokwim, which, heading in the western part of this group, flows southwest into Bering Sea. In the region north of the Yukon valley originate many streams, including several large branches of the Yukon, as the Porcupine and Koyukuk; other streams, as the Noatak and Kowak, flow into Kotzebue Sound, and still others, as the Colville, flow northward into the Arctic Ocean.

The country is intersected by a network of rivers and lakes navigable for canoes, although navigation is much interrupted by rapids and falls. The great highway of the territory is the Yukon River, which, heading in British Columbia, flows northwestward through a succession of lakes and rapids, and crosses the boundary line in latitude 65°. It reaches its most northern point just on the Arc-

[1] Latitude 63°, longitude 149°.

PHOTOGRAPH BY MERRIAM

MT. FAIRWEATHER
ALT. 15,292 FT.

MT. LITUYA
ALT. 11,832 FT.

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tic Circle, in longitude 146°, and thence flows southwestward to its mouth. It is navigable for small steamers throughout its course in Alaska, and when not closed by ice, that is, from June to October, carries much traffic, since the greater part of the food, supplies, machinery and other goods for the support of the mines in Alaska and the Klondike come by this route.

North of the Yukon most of the land is permanently frozen at a depth, thawing only near the surface in summer. Wherever the slopes are at all gentle such ground is marshy, forming the well-known tundra of the Arctic regions.

CLIMATE.

We must speak of the climates rather than the climate of Alaska, for different parts of the Territory differ in climate, not in degree only, but in kind. The Pacific coast has a climate of its own, the coast of Bering Sea has another, and both differ widely from that of the interior.

The climate of the Pacific coast, from Portland Canal in the extreme southeast to Attu Island at the west end of the Aleutian chain, may be characterized, in a word, as 'chilly.' Take the well-known climate of San Francisco with its dampness, fogs, and cold sea winds, reduce the temperature 15 to 18 degrees and increase the dampness and fog in proportion, and you have a fair idea of the climate of the Alaska Pacific coast. At Sitka, in latitude 57°, the mean annual temperature is 43° Fahr., which is about the same as at Eastport, Maine, 12 degrees farther south. The extreme range of temperature on record at Sitka is from a trifle below zero Fahrenheit to 90° above, and the monthly mean temperatures range from 31° to 56° only, illustrating the wonderfully uniform temperature of the Pacific coast. At Kadiak, 16 degrees farther west and a degree farther north, the mean temperature is 2°

lower and the extreme range of temperature less. At Unalaska, 3 degrees south of Sitka, the mean temperature is only 36° and the range of temperature is still smaller.

While the mean annual temperature on this coast, whose latitude ranges from 54° to 60°, does not differ materially from that of Eastport, Maine, on the Atlantic coast in latitude 45°, the summer temperature is much colder and the winter temperature much warmer. The statement has been made that it is no colder at Sitka than in Georgia. I believe this to be true in the sense that the minimum temperature is no lower, but it represents only a part of the facts, and much the less important part. It is also true that it is no warmer at Sitka than it is on the Arctic Circle, that is, the maximum temperature is no greater, and for most economic purposes except the making of ice, it is warmth, not cold, that concerns us.

The annual rainfall is heavy over this entire coast. At Sitka it is more than double that of the Atlantic coast, 105 inches a year being the record, and it diminishes but little westward. At Unalaska the record is 92 inches. Rain falls mainly in the autumn and winter, the summer being comparatively dry.

A description of climate would be incomplete if it did not include the amount of sunshine and cloudiness, since these are important factors in the growth of plant life. At Sitka it is cloudy two-thirds of the time, and nearly half of the time it is raining or snowing. At Kadiak the conditions are a little better; at Unalaska they are worse, for Unalaska is unrivaled for bad weather. Only eight days in the year, during several years of record, were entirely clear, and only 45 partly clear, the remaining 312 being cloudy, and 271 of those were rainy or snowy.

Before attempting to explain these peculiarities of climate it should be stated that the sea commonly produces

PHOTOGRAPH BY CURTIS

ISLETS IN SITKA HARBOR

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two modifications of temperature. It may reduce the extremes, making the atmosphere cooler in summer and warmer in winter, and it may reduce or increase the mean annual temperature. The Pacific coast of Alaska is within the range of the prevailing westerly winds of the Northern Hemisphere. These winds come off the ocean, bringing to the coast the temperature of the sea. As the sea absorbs heat slowly, in comparison with the land, and parts with it as slowly, the winds blowing off it are cool in summer and warm in winter. Moreover, since the ocean has waves, tides, and currents, by which its waters are moved about, the cold water of the north toward the south, and the heated water of the tropics toward the north, there is a tendency to establish an equilibrium of temperature. Thus the northern seas are warmer on the whole — that is, the mean annual temperature is higher — than land in the same latitudes, and through the agency of the westerly winds the coast shares in this amelioration of temperature.

These same westerly winds are responsible for another feature of the climate, the heavy rainfall. They come from the sea saturated with moisture, and if they find the land colder than they are, as it is in fall and winter, they are chilled below the point of saturation and disgorge copiously; but if they find the land warm, as it is in summer, they carry their moisture inland and the coast enjoys a comparatively dry season. This season is, however, dry only in comparison with the winter, the wet season. The rainfall of the three winter months at Sitka is commonly about 30 inches, while that of the three summer months is 16 inches, or more than half that of winter.

The fogs of this coast, really the most obtrusive feature of the climate, occur whenever the wind blows from the sea, which it does most of the time, even in summer. For

obvious reasons they seldom or never occur with a land breeze.

The coast of Bering Sea has a climate widely different from that of the Pacific coast. The mean annual temperature is much lower, even after due allowance for the difference in latitude. At St. Michael it is 26°, and at Port Clarence, in Bering Strait, it is 20°. The range of temperature is much greater. The mean temperature of the coldest month at St. Michael is —2°, of the warmest month 54°, showing a range of 56°. Similarly, at Port Clarence the coldest month is —11°, the warmest 50°, a range of 61°. The highest temperature on record at St. Michael is 75°, the lowest —55°, a range of 130°. The contrast with the Pacific coast is still greater in the matter of rainfall, which at St. Michael is very light, amounting to only 14 inches annually. Moreover, rain falls in the warm rather than in the cold season.

The temperature of this coast is not much modified by the sea. Bering Sea is practically a closed sea, the Aleutian Islands forming a partial barrier against the warmer waters of the Pacific; consequently its waters retain, to a large extent at least, the temperature incident to the latitude. Its mean annual temperature is little affected by outside influences, and the greater part of it is frozen for half the year. The extremes of temperature, however, are reduced by the slow absorption and radiation of heat, just as with the Pacific. As this region is north of the territory of the prevailing westerlies, the winds have no prevalent direction, but blow whithersoever they list. For the same reason the rainfall is light. Though the air over the sea is saturated with moisture, little of it drifts over the land to supply rain.

If there is a region more infested with fogs than the Pacific coast of Alaska it is Bering Sea. Here fog is the normal condition, and clear, bright weather the rare ex-

PHOTOGRAPH BY HARRIMAN

MOUNTAINS ON ALASKA PENINSULA

PHOTOGRAPH BY CURTIS

JOHN ANDREW & SON

ENTRANCE TO SALDOVIA, KENAI PENINSULA

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ception. It is no uncommon experience for vessels bound for the Pribilofs to miss the islands in the fog, and to spend days searching for them, as for needles in a haystack. They are a small target to shoot a vessel at from Unalaska, 250 miles away, and once missed, are not easily found in this great foggy waste.

The climate of the great interior region is that common to the interior of all continents. The mean annual temperature is practically the same as in the same latitude on the coast of Bering Sea, but the range of temperature is much greater. It is warmer in summer and colder in winter, since the land heats and cools much more rapidly than the sea. At the point where the international boundary crosses the Yukon River the mean temperature of the coldest month (in 1889) was — 17°, that of the warmest month 60°, a range of 77°. Contrast these figures with those given above for Sitka, where the corresponding range was only 26°. Furthermore, consider that the mean temperature of the warmest month on the Yukon, in latitude 64° 41′, was 4° higher than at Sitka, over 500 miles farther south. These figures are instructive in pointing the conclusion that if any part of Alaska can become of agricultural importance it is the interior rather than the Pacific coast. But it is doubtful whether even this region will admit of profitable farming. In connection with this question the experience of the Canadians is instructive. On Peace River, in latitude 56°, 600 miles farther south, many and persistent attempts at farming have been made, but without financial success, although it is doubtless true that certain crops have been matured there.

The extreme range of temperature in the interior is surprising, even to those accustomed to roast by day and freeze by night in our western deserts. At this same point on the Yukon, temperatures of — 60° and of 87°

have been recorded, a range of 147°. Again contrast this with Sitka, where 90° is the extreme range record.

The rainfall in the interior is light, ranging at various places and in different years from 10 to 25 inches. With the cold climate and consequent slight evaporation, it is probably sufficient in the majority of years for agricultural requirements. Differing radically from the coast climates, this climate is bright and sunny. There is little dull, cloudy weather, and practically no fog. There is more sunshine here in a month that at Sitka in a year.

FORESTS

The coast, as far to the westward as Cook Inlet, is densely forested up to the timber-line, which ranges with the latitude from 3,000 to 2,000 feet above sea-level. The timber is mainly, indeed almost entirely, Sitka spruce. There is some hemlock at higher levels, and in the southern part a little cedar also, but these are of little commercial importance. Red or Douglas fir, which forms the bulk and principal value of the forests of Washington, disappears in British Columbia. The spruce is large and fine, as judged by eastern standards, but as compared with the timber of Oregon and Washington, which is the standard on the Pacific coast, it is inferior, and little use is at present made of it, most of the timber needed being brought from Puget Sound. On Kadiak and the adjacent islands there is little timber, and farther west on the Alaska Peninsula and the Aleutian Islands, none whatever; nor are there any trees on the islands in Bering Sea. Why the timber should thus suddenly disappear on the peninsula and islands is an open question. The rainfall is ample, and the climate little more severe than at Sitka, and less severe than about Prince William Sound. The suggestion that high, cold winds prevent tree growth is negatived by the fact that such winds occur all along

COLUMBIA GLACIER AT CONTACT WITH ISLAND

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the coast, in forested as well as non-forested parts. Moreover, the forest-fire fiend has not been here.

The interior of the territory is forested, mainly with spruce, as far north as the valley of the Koyukuk, and as far westward as the delta of the Yukon. In this enormous region there must be a very large amount of coniferous timber, sufficient to supply our country for half a generation in case our other supplies become exhausted.

POPULATION.

The population of Alaska in 1900, according to the Twelfth Census, was 63,592, having nearly doubled in the preceding ten years. Of the total increase, 31,540, about three-fourths was acquired by that portion of the territory lying north of the Yukon River, and only one-fourth by that portion south of that river, including southeastern Alaska. Half of the increase in northern Alaska consisted of the people of Nome, which had a population of 12,486, by far the largest aggregation of people anywhere in the Territory; the remainder were scattered widely over its great area, but mainly in the valley of the Yukon and along the coast north of the mouth of that river.

In southern Alaska the population increased almost everywhere, but not by any means at so rapid a rate as in certain localities in northern Alaska. Skagway had a population of 3,117, Sitka of 1,396, Juneau, 1,864, Douglas, 825, Wrangell, 868, and the Indian village of Metlakahtla, 465.

Of this total population about 25,000, or a little more than two-fifths, were Indians, Eskimos, or mixed bloods, the remainder being whites. The increase during the past ten years probably consists entirely of whites.

The population is in high degree a floating one, with the slightest possible attachment to localities, and subse-

quent censuses will doubtless show radical changes in its distribution.

RESOURCES

The natural resources of Alaska are enormous. The skins and furs, the fish, the gold, copper, and coal, and the timber of the territory are in value almost beyond calculation, and the mere reaping of this harvest sown and ripened for us by nature will occupy an industrial army for many years. The wealth thus collected will add greatly to the well-being and happiness of our people.

Some of these natural resources, however, have begun to suffer from the drain to which they have been subjected. The gathering of furs and skins, which has been in progress since the early Russian occupancy of the territory, has been prosecuted so actively that the fur trade is now of comparatively little consequence. Blue foxes are now so valuable that systematic attempts are being made to breed them for their skins. The sea otter has become very rare, and the value of its skin correspondingly high. The fur-seals, on account of pelagic sealing, are now reduced to a small fraction of their former number and only 24,000 skins were obtained at the seal islands in 1899. Even the great brown bear has become scarce and shy, and hides in the fastnesses of the interior, away from the seaboard, where he was formerly abundant.

The seabirds, once plentiful all along the coast, are now driven to the rarely visited parts, where, particularly on the islands of Bering Sea, they may yet be found by millions.

Fish are still abundant, but the salmon canneries have already reduced the supply in many of the rivers, and the erection of new canneries along the coast will soon make the reduction more apparent. During the year 1899 these canneries packed and shipped 1,100,000 cases and 25,000 barrels of this fish.

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PHOTOGRAPH BY MERRIAM

GILBO & CO

FUR-SEALS, ST. PAUL ISLAND, BERING SEA

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The mineral resources of the Territory are yet in an undeveloped condition, but unless all signs fail, the chief wealth to be obtained from Alaska will be taken from the ground. Coal is known to exist in many localities, but is nowhere, as yet, mined on a commercial scale, owing mainly to its inferior quality; the coal in use at present is brought from Nanaimo or Puget Sound. Copper vein deposits of great magnitude and richness have been found, notably on Copper River and the shores of Prince William Sound, but as yet none of them have been developed, beyond the shipping of a few hundred tons of ore for testing. Gold deposits, both placer and vein, have been found in various places all over the territory. They are so widely distributed and so rich as to lead to the conclusion that with more extended and thorough prospecting, the known auriferous areas will be vastly increased and the yield of the yellow metal multiplied many times. Some of the quartz mines, as the Treadwell, near Juneau, have been worked productively for many years. This mine alone has produced about $10,000,000. Others have recently become productive, and still others, more numerous, are yet in the development stage. The mines near Juneau produced, in 1899, gold of the value of nearly two million dollars. At several localities in southeastern Alaska and on the Shumagin Islands quartz mines have been discovered, but at present placers are far more abundant. They have been found on many of the tributaries of the Yukon, especially on those from the south, the Sushitna, the Kuskokwim, and the Koyukuk, and in the north, the Ambler and the Noatak. At several places gold has been found in the beach sands on the seashore, and last, but by no means least, on the beach and the stream-beds at Cape Nome and Port Clarence. These last discoveries seem to be the greatest of the whole northwest, rivaling, and prob-

ably exceeding, the great Klondike discovery, for many millions appear to be in sight, awaiting the pan or rocker to separate the golden sand. The harvest of gold from Cape Nome during the summer of 1900 was $5,000,000 and the total product of the Territory from placers in 1899 was $5,500,000.

But after the enumeration of these latent resources of the Territory few are left to describe. Alaska is not a country for agriculture, nor for home-making. It has paid us its purchase price many times over, and in the future will pour much wealth into our laps, but it will never pay, as other accessions to our territory have paid, in making homes for our people. At present few people go to Alaska to live; they go merely to stay until they have made their stake.

Farming as a business is impossible under the climatic conditions prevalent on the coast. It is granted at once that it is possible to mature certain hardy crops in favorable seasons, but this is quite a different thing from raising crops in competition with California and the Willamette valley, even when the cost of freight is added. It must be done at a profit or not at all. It is of no avail to raise potatoes when they can be brought from Portland and sold for less than the cost of production in Alaska. If there is any part of the Territory in which farming can be successfully carried on, it is the interior, which has a much more favorable summer climate than the coast; but even there success is doubtful. However, as the higher rate of freight to the interior will have the effect of a protective tariff on home products, it may be possible to raise grain and vegetables at a profit under conditions which would be prohibitory on the coast.

SCENERY.

There is one other asset of the Territory not yet enumerated, imponderable, and difficult to appraise, yet one of the

PHOTOGRAPH BY MERRIAM.

A. HOEN & CO. BALTIMORE

BRYN MAWR AND SMITH GLACIERS, COLLEGE FIORD, PORT WELLS

June 26 '83

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chief assets of Alaska, if not the greatest. This is the scenery. There are glaciers, mountains, and fiords elsewhere, but nowhere else on earth is there such abundance and magnificence of mountain, fiord, and glacier scenery. For thousands of miles the coast is a continuous panorama. For the one Yosemite of California Alaska has hundreds. The mountains and glaciers of the Cascade Range are duplicated and a thousand-fold exceeded in Alaska. The Alaska coast is to become the show-place of the earth, and pilgrims, not only from the United States, but from far beyond the seas, will throng in endless procession to see it. Its grandeur is more valuable than the gold or the fish or the timber, for it will never be exhausted. This value, measured by direct returns in money received from tourists, will be enormous; measured by health and pleasure it will be incalculable.

There is one word of advice and caution to be given those intending to visit Alaska for pleasure, for sight-seeing. If you are old, go by all means; but if you are young, wait. The scenery of Alaska is much grander than anything else of the kind in the world, and it is not well to dull one's capacity for enjoyment by seeing the finest first.

Chas. P. Hodgson
1900

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Sunset, Yakutat Bay

THE ALASKA ATMOSPHERE

BY WM. H. BREWER

THE aspects of the sky and atmosphere along the Alaska coast have a character unlike that of any other part of the United States, and give an especial interest and charm to the scenery. For a better understanding of its peculiarities, a short statement of a few elementary facts regarding the air may be given by way of preface.

The gases which compose the atmosphere are all transparent and if the air contained nothing else, we would have clear weather all the time. We should then see distant objects more plainly, but all the other effects of light and shade and color in landscape and sky would be very unlike what we actually see in nature. The difference in the appearance of the landscape from what it naturally is, would be greatest in the warmer and least in the colder climates. There would then be little color in the landscape and none at all in the black cloudless sky. But the atmosphere contains dust and smoke and haze and fog and cloud, and these, in one way or another, give it all its varying aspects. The clouds may be of fine particles of water or of ice.

The phenomena of color are due to the different wavelengths of light, longer waves producing red, shorter ones

violet, the different lengths of the light-waves producing all the colors observed in the rainbow. When the dust-particles in the air are smaller than a wave-length of sunlight, they break up the waves and cause a variety of color effects dependent on the size and other conditions of the particles. The afterglow, seen in the sky just after the sun sets, is caused by particles of dust or ice suspended in the air. The color of the glow is red or orange or yellow, according to the coarseness of the particles, the brilliancy of the coloring being related to certain other conditions. The red color of the disk of the sun or the moon, seen through the smoke of burning forests, or through the dense haze in very dry weather, is due to the same cause. So too is the green sun, sometimes seen through air laden with finer dust from volcanic eruptions, or even the dust from deserts.

All the haze and turbidness of the atmosphere and all the colors of the sky are due to suspended particles of dust or smoke or water or ice. Cloud consists of fine particles of water, which become frozen into very fine particles of ice in the cold upper air. The different degrees of fineness of the suspended particles give different colors to the sky itself. The dust particles are finer in the upper air and they make the sky blue, and the sky is deepest blue where the suspended dust is finest. For this reason the sky is always of a deeper blue when seen from the summits of high mountains. From very high peaks the very dark blue sky has often a violet tinge, due to the exceeding fineness of the dust in the thin, dry, upper air.

No region has yet been discovered in which the air is entirely free from dust. The shadows of high mountains are often projected against the sky at sunrise and sunset in clear weather and are due to it. The general fact has often been described, particularly as observed from the higher mountains of the western United States, and pho-

PAINTING BY F. S. DELLENBAUGH

A. HOEN & CO. BALTIMORE.

LONG MOUNTAIN, UNALASKA, FROM DUTCH HARBOR

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tographs have been taken of the shadows of Pikes Peak and of Mount Hood and perhaps of other mountains. When seen under the best conditions, this shadow constitutes a phenomenon of indescribable impressiveness. I have a most vivid recollection of such a scene from one of the high volcanic cones of northern California, which may be cited as an illustration. We had climbed the peak in the night and were on the summit until midday. The sky was absolutely cloudless and the air still and exceptionally clear, having been purified by a recent storm. Never before nor since have I had a wider view. Points two hundred miles distant were sharply defined on the horizon, yet, even in that clear air, there was dust enough to serve as a screen on which the grand picture was thrown. As the sun rose, a giant spectral mountain appeared against the opposite sky. It was of deep cobalt blue sharply defined against the lighter 'azure-blue' of the sunlit air about it. An optical illusion greatly magnified its size. Owing to the curvature of the earth's surface, it reached high in the sky and far above the Coast Ranges on the western horizon. It was much higher than any real mountain on earth, but as the sun mounted higher the spectre sunk lower until it disappeared.

The shadow of the earth itself may often be seen in the eastern sky on a clear evening. Just after the sun disappears, a dark band appears along the opposite horizon and slowly creeps upward. It is darker blue in color than the sky above it and is often bordered on its upper edge by a fringe of faint rose-color which sometimes takes on a distinctly purple hue.

When farthest north on our Alaska cruise, the earth shadow was especially interesting, and its appearance indicated the great purity of the air there as related to dust or smoke. The long Arctic twilight is sufficient evidence

that there is enough suspended matter, even there, to make a luminous sky on which shadows can be cast. The night we steamed across from the Asiatic to the American coast, just below Bering Strait, the southern sky was cloudless, there was no moon, and the earth shadow was very distinct. It was a grand arch of deep blue which slowly rose and crept along the southern sky, attaining at midnight the height of thirty or forty degrees. It was very much higher than I have ever seen the shadow in lower latitudes. It was very distinct as to shade, although not so sharp in outline as we see at home. There was no tinge of rose or purple, although we had some red and crimson clouds in the north. The arch moved westerly across the southern sky and vanished before it sank to the horizon.

It was discovered, some twenty years ago, that when the vapor of water condenses and forms fog or cloud, it must have dust particles to condense upon. Without dust there is no fog nor cloud; the more abundant the particles, the denser the fog or cloud may become. This discovery has attracted much attention among meteorologists, and ingenious methods have been devised to count the number of dust-particles contained in a measured quantity of air. Thousands of such countings have been made. The air has been examined in many countries and many places—over sea and land, on mountains and in valleys, in cities and in the country. Numerous tables giving the numbers found in various localities, have been published in scientific works. It is enough here to say, that the number varies greatly, ranging from a very few in the purer air on high mountains to many thousands of particles in a single cubic inch of city air, but I am not aware that any such observations have ever been made in any high latitude. The vast arctic region is mostly covered by water, ice or snow, and with its scanty population

PHOTOGRAPH BY MERRIAM

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DAVIDSON GLACIER, LYNN CANAL

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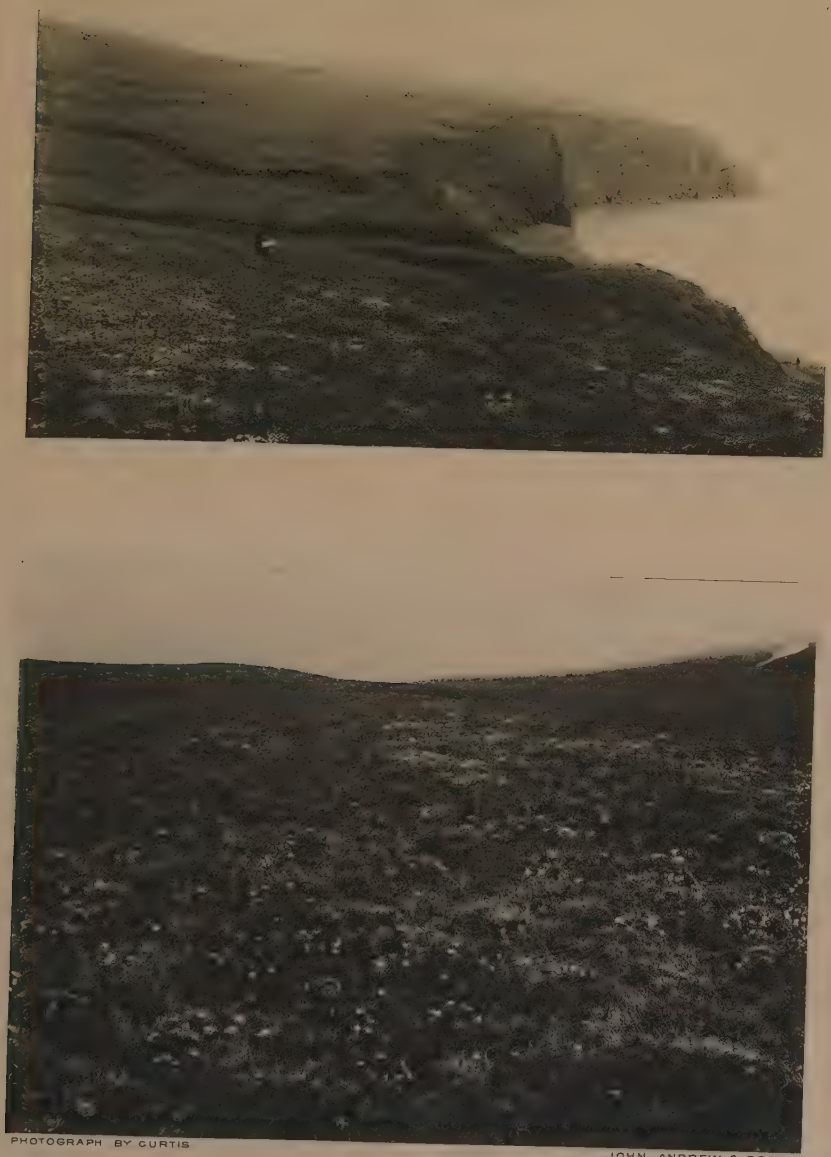
and its abundant storms to wash the atmosphere, the amount of dust in its air must be very much less than in the air over more densely inhabited countries and in warmer climates. A few years ago I made a series of observations on atmospheric appearances along the coasts of Labrador and Greenland and in Baffin Bay up to the Arctic Circle. All the phenomena there are in accordance with what we might expect from an atmosphere containing only fine dust and vastly less in quantity than is found in all warmer latitudes. I made similar observations on the aspects of the sky and air every day of the Harriman Alaska Expedition.

Westerly winds prevail along the western coast of North America from Mexico northward. Coming over the broad Pacific, they lose on the way much of the dust that had been gathered from other regions. This explains the cause of the very clear air of California and the other Pacific States. Near the coast the air when dry and without fog is marvelously clear. From California northward to Alaska, forest fires later in the season often make a very smoky atmosphere. As we steamed up the inland passage northward, the blue haze, due mostly to smoke, rapidly diminished, its softening effects upon the landscapes grew less and less, and from Glacier Bay on our way out until we reached Yakutat on our return, we saw practically none of the effects of a smoky or a dusty atmosphere. We sometimes had a haze when the air was nearly saturated with moisture, but it was never a blue haze — always white like a faint transparent fog. When the air was dry, the atmosphere was then always very transparent and distant objects were marvelously distinct. When the moon rose, it was bright and white and without color. I watched its rising several times when it was as white and clear at the horizon as it was when it reached mid-sky, without a tinge of color and with no perceptible diminution of its

light. I have in mind one evening while on the way up, the half full moon when rising seemed poised, as it were, on the very summit of a low peak which was but a short distance inland. The dark crags of the peak were sharply cut on the intensely white face of the planet, which by the contrast, seemed even brighter than when in mid-sky. A year before, I had watched the moon rise and set behind the mountains of the Mont Blanc group. Although it seemed clear and bright in that mountain atmosphere, yet it was not so white as we saw it in Alaska. Mont Blanc has densely populated countries on all sides of it, the smoke from cities and towns, the dust from highways and tilled fields, the various kinds of pollution which civilized regions furnish, affected the atmosphere sufficiently to be seen even on the whiteness and brightness of the moon. The Queen of Night keeps her whitest robes for display in the higher latitudes. It is, however, only fair to say that on our way home, by the time we reached Yakutat the forest fires had already begun inland and the moon rose with a blushing face.

The peculiar clearness of the air lends a special charm to the near views of a flower clad landscape. Examples of this we often had on the islands. But the more distant landscapes lack the softening shades we are familiar with at home; their beauty is of entirely another kind but not less interesting. They lack the soothing quality of the landscapes in hazy air, such as we have in warmer climates and more populous countries, where landscapes fade away by insensible gradation into the dreamy distance, and the horizon is indefinite and mysterious. In Alaska, the horizon often seems wonderfully close to us even when we know it is distant. We are so accustomed at home to see distant objects more dimly because of the haze, that we think objects must be near if they are sharply distinct.



PHOTOGRAPH BY CURTIS

JOHN ANDREW & SON

BOTANIZING ON HALL ISLAND

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When we had fogs they were rarely so opaque as those we are familiar with at home, and very much less dense than the fogs off the coast of Nova Scotia and Newfoundland. It is probable that there is not dust enough in the air to form sufficient nuclei for the quick condensation of such thick fog as is common off the eastern coast below Labrador. The fogs were, however, wet enough to make up for their lack of opacity, although not so wet as occur on Baffin Bay and along the coast of Greenland.

It is the dust and the particles of ice or half condensed watery vapor suspended in the air that scatter the light and make the atmosphere seem luminous. Much dust in the air diminishes sensibly the actual amount of light that reaches the surface of the earth and also changes its character. Therefore, we often had an abundance of light on cloudy days, in fact more than one would suppose. The wonderful clearness of some of the photographs which were taken by the party on cloudy days is one evidence of this. This quality of the light in Alaska was a factor in the production of so many successful photographs by the party and gave many of them exceptional beauty and excellence.

As to the clouds, we saw none with rounded heads ('cumuli' as meteorologists call them) north of the Alaska Peninsula and but very few anywhere along the Alaska coast. Over Bering Sea and northern coasts the clouds had ragged edges, shreddy, never sharp in outline — none with rounded heads such as form a factor in the summer sky-scenery of warmer lands. Both as we went out and on our return, a few cumulus clouds curled over the peaks on the Peninsula, but the clouds that adorned most of the mountains were not sharply outlined; they sometimes stretched away from the summits like frayed banners.

Some of the cloud effects were, however, especially beautiful. Photographs of clouds are, as a rule, very unsatisfactory, but many of those taken on this trip show cloud scenery with a beauty rarely equaled. The lights and colors on the clouds seen in the long twilights of those high latitudes, although longer in duration were not more brilliant than in lower latitudes.

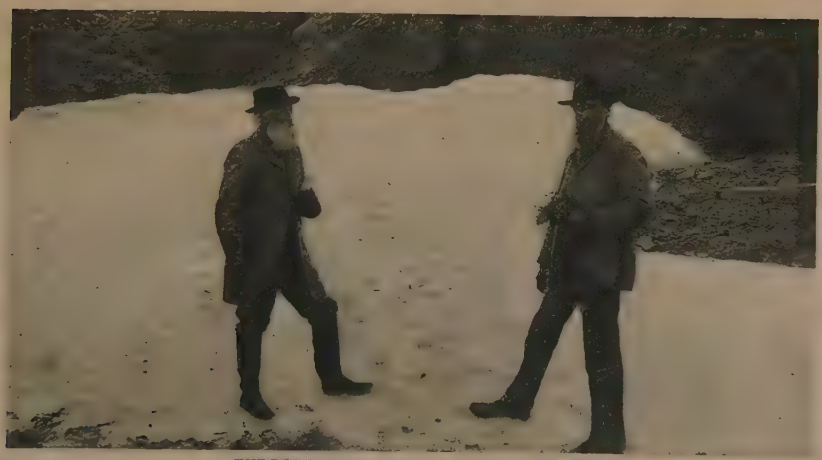
Rose and crimson clouds sometimes lingered in the northern sky during the whole interval between sunset and sunrise. They were very brilliant in Bering Strait during the short bright night of July 11–12.

As to the color of the sky itself, it was never dark blue north of latitude 55° or 56° — always a lighter blue than we have on clear days in middle and lower latitudes. It was deeper blue than the sky along the eastern coast of North America in the same latitudes, but not so deeply blue as in the warmer regions we are more familiar with.

The colors of sunsets and sunrises were not so varied as at home. This applies both to the sun-glows in the clear sky along the horizon just after the sun's setting, and to the red or crimson colors of the clouds later, and there was little to distinguish them from those of our home experience, either as to shade or intensity of color. The disk of the sun, before setting, was never reddened, but had varying shades from white brightness to golden yellow. Although the disk never reddened, the afterglow in the sky, near the horizon, was often rose-colored, salmon and even orange. Sunrises came so inconveniently early that few observations were made.

Now and then we had a mirage over the water, when the air was temporarily still enough and the temperature right for them to form, but they were neither so striking nor so frequent as along the coast of Labrador in the same months. Nevertheless, there were one or two which were beautiful for a while, and which linger in the memory.

COVILLE BREWER



BURROUGHS MUIR

PHOTOGRAPHS BY CURTIS JOHN ANDREW & SON

EMERSON GILBERT

MEMBERS OF THE EXPEDITION ON ST. MATTHEW ISLAND

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The rose-colored illumination of the snowfields on high mountains opposite the setting sun, called 'Alpen Gluehn' or 'Alpine Glow' in Switzerland and which constitutes one of the beauties of snow-clad mountains, we had in great perfection on several occasions. I had previously attempted to make comparisons of the colors of the 'Alpine Glow' as seen in different regions. The earlier observations are recorded only in memory, but of later ones careful notes were taken at the time of observation.

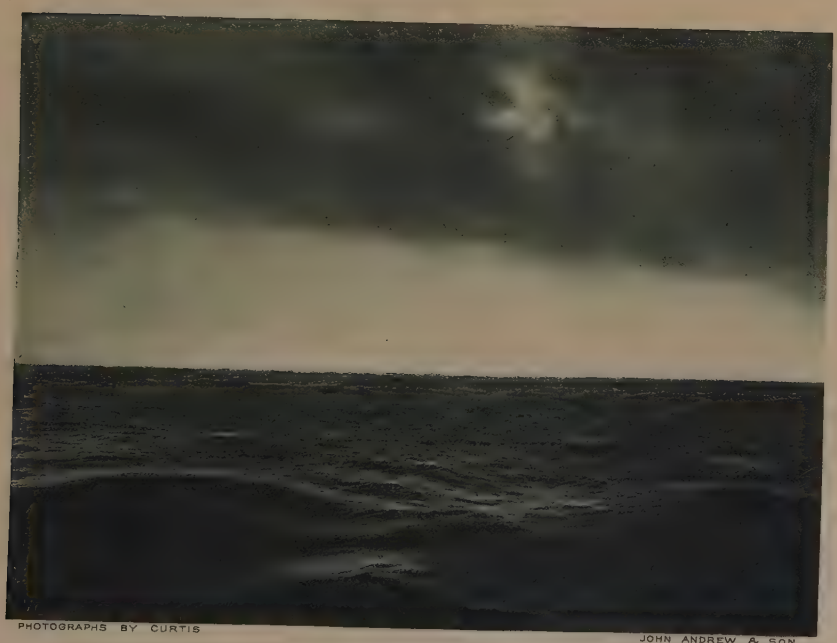
As seen on the snows of the Rocky Mountains and on the mountains of southern California in winter and under clear skies, the glows, as I remember them, were more distinctly rose-red in color and more luminously brilliant than in any I have seen elsewhere. On the lofty peaks of the Cascade Range later in the season and when the smoke of forest fires prevails, they are much less luminous and the colors much duller, sometimes appearing maroon or even brown in the smoky air. I have seen very similar colors on the Bernese Alps, viewed from Interlaken, during a very dry time in autumn.

From various points of view we had these glows of exceeding beauty on the mountains along the coast and on the islands, and their colors were carefully noted during their occurrence, from the time when the first blush of rose began to appear until all the color was quenched in the twilight. The year before I had exceptionally good opportunities of making similar observations in Switzerland and to note in the same way the glows on the snowfields of the Mont Blanc and Monte Rosa groups, and thus can the better compare the impressions as to colors and beauty, between the phenomena as seen in the dustless and smokeless air of the Alaska coast, and the effects in the dustier and smokier air of Switzerland. The color effects in Alaska were the more beautiful, the colors more

clear and brilliant, and the tints have a more decided suggestion of blue or violet in the red. During the time of greatest intensity of color, the rosy tints pass through what might be called peach-blow color rather than pure rose-color. They were also more brilliant and of very much longer duration. At times they seemed almost blazing with color, as if self luminous. Then, too, when the shadows of other peaks were projected on such sunlit snowfields and crept up the slope, gradually quenching its color, the contrast between the rosy illumination above and the bluish-gray shadow below was much stronger than I have seen elsewhere. The shadows themselves were bluish gray, and the blue tinge was at times very perceptible. Attractive as these phenomena are wherever found, I have never seen them anywhere else so fascinatingly beautiful in their contrasts of color, nor so prolonged in the display.

On July 6th the western sky was cloudless when the sun set behind very snowy mountains on the Alaska Peninsula. The illumination was exactly the reverse from that which produces the 'Alpine Glow.' Before the sun touched the horizon the snowfields directly beneath the disk and stretching along the ridge either way, glowed with wonderful brightness. They gleamed brighter and brighter like flame itself as the disk neared the horizon and slowly sank beneath it. The glow was then quenched with a suddenness that seemed almost startling. The air was probably at that height very dry, and too pure and moteless to be of itself as luminous as is common along the horizon beyond which the sun usually sets. Hence the suddenness with which the brilliancy ceased when the sun was actually out of sight and the scanty afterglow in the sky near its place of setting. It was one of the most striking sunsets I ever beheld.

SUN AND CLOUDS



PHOTOGRAPHS BY CURTIS

JOHN ANDREW & SON

LAST VIEW OF THE PACIFIC

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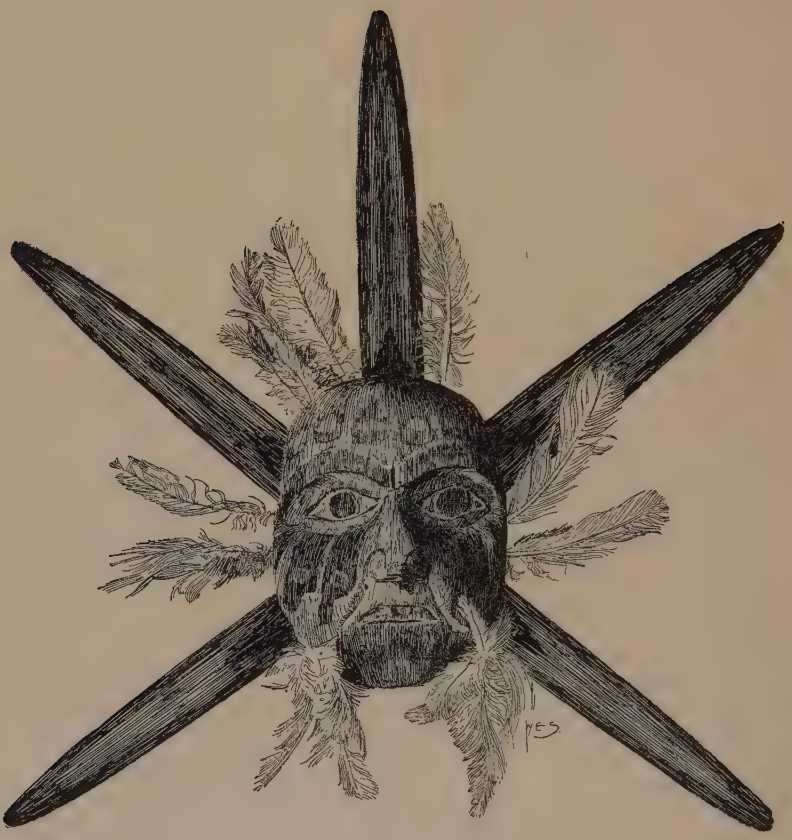
There is reported to be usually more fog along the Alaska coast, and especially later in the season, than we found during the months of our cruise. But, during that June and July, the aspect of the sky, the sharpness of the views and the other phenomena incident to the character of the air contributed greatly to the pleasure of the trip. It was a phase of Nature so unlike what we have at home that it cannot be forgotten.



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BOGOSLOF VOLCANO. BERING SEA

AUGUST 11, 1891

BOGOSLOF, OUR NEWEST VOLCANO

BY C. HART MERRIAM

A SMALL spot in Bering Sea about thirty miles north of the island of Umnak and forty miles west of the northern corner of Unalaska, has been in recent years the seat of more violent volcanic activity and has undergone greater changes of form than any other part of North America. In this spot, early in May, 1796, accompanied by thunder, earthquake, and steam, a volcanic island was suddenly thrown up from the depths of the sea; and again, no longer ago than the summer of 1883, the waters were once more convulsed, and, shrouded in steam and fog, a companion volcano was born.

OLD BOGOSLOF.

The birth of the new volcano seems to have escaped observation, but the terrific disturbances attending the upheaval of old Bogoslof were witnessed not only by native Aleuts on the islands of Umnak and Unalaska, but also by the resident agent of the old Russian-American Company, one Kriukof, who at the time chanced to be on the northernmost part of Umnak. Kriukof told Kotzebue that on May 7, 1796, a storm from the northwest cut off the outlook seaward; that on the 8th, when the weather had

cleared, there was seen a few miles away a column of smoke, beneath which at evening something black appeared. During the night fire arose in this place and at times became so bright that every object on the island could be clearly distinguished. An earthquake shook the island (Umnak), and a terrific roaring came back from the mountains to the south. The rising island twice hurled stones as far as Umnak, a distance of thirty miles. At sunrise the earthquake ceased, the flames diminished, and the newly risen island was seen, shaped like a black pointed cap. A month later, Kriukof found it considerably higher. Meanwhile fire had been thrown up continuously. Afterwards the island grew both in circumference and height, the flames diminished, but steam and smoke rose incessantly. After four years the smoke ceased, and after eight (1804) sea-lion hunters who visited the island found the water warm and the ground so hot that no one could walk on it.[1]

While at Unalaska in 1817, Kotzebue was informed by a trustworthy Russian that for a long time the island had continued to increase in size and elevation; that its circumference was estimated at two and a half miles and its height at 350 feet, and that for three miles around it the sea was covered with stones (doubtless pumice, which floats on water).

Baranof states that Bogoslof was again visited in June, 1814 (Grewingk insists that this is an error for 1804) and a landing effected at a low place where a large herd of sea-lions had hauled out on the rocks. It was then found

[1] In the above account, and in other early descriptions that follow, the language of the original is in the main preserved. Had the observations been made by geologists, the words 'fire' and 'flame' would probably not appear, as it is well understood that the bright glow of a volcano is not fire in the proper sense of the word, but the incandescence of molten lava which has come up from the interior of the earth. Real flames are rarely seen in volcanoes; the supposed flames are usually illuminated clouds above the glowing crater. The so-called smoke clouds are composed of fine rock dust.

that the island abounded in craters from which small stones were being constantly thrown out, obstructing the view and building up the flat portion of the island. Finding it impossible to explore on land, the party sailed around it. A year later, a second expedition found the island much lower and its appearance wholly changed.

By the Aleuts the island was called *Agáshagok*, but the Russians called it *Joánna Bogoslova*, St. John the Theologian, after St. John's day of their calendar.

Langsdorf, who visited Bering Sea in 1806, gives an account of Bogoslof as he received it from the natives at Unalaska, and then briefly describes its appearance as seen by him on August 18 of that year. He was told that in this place "had long stood an insulated rock, which, the Aleutians say, was always in the times of their forefathers one of the great resorts of the sea-dogs and sea-lions, with which these parts abound.

"In the year 1795, the islanders remarked a great appearance of fog in the neighborhood of this rock, which did not disperse, although the rest of the atmosphere was perfectly clear; this gave the greater uneasiness to the people both of Oonalashka and Umnak, since they considered the rock as one of their great magazines of food. After vainly expecting for a long time the removal of the phenomenon, and afraid, uncommon as such an appearance was, to venture near it; at length, one of the Aleutians, bolder than the rest, resolved to visit his ancient haunt, and endeavor to catch some sea-lions. He soon returned in the utmost terror and astonishment, saying that the sea all about the rock boiled, and that the supposed fog was the smoke or vapor that rose from it. Nobody would in consequence venture any more near the place; concluding, that instead of sea-lions and sea-dogs, it was become the abode of evil spirits. This continued for a considerable time, till at length, about five years

after, the fog suddenly clearing away, the Aleutians, instead of their rock saw an island, from which rose a high peak, in form resembling a chimney, with fire and smoke issuing from it as if it had really been one."

Continuing, Langsdorf states: "Some inhabitants of Oonalashka, in the month of April, this year [1806], consequently not a very long time before my arrival, had visited this island, going in three baidarkas, and gave me the following account: They were about six hours rowing round it, which supposes a circumference of about thirty versts [20 miles]. They could not ascertain the height of the peak with any precision, but were of opinion that if it had been possible to climb directly up to the highest point, they could not have done it in less than between five and six hours. The volcano was burning on the north side, and the lava, which they represented as a soft matter, ran down the side into the sea. It was impossible to land on account of the heat: on the south side of the island alone, where the shore was not so steep, and where the great heat of the volcano was not so much felt, could they effect a landing. They endeavored to ascend the peak, but found the ascent extremely difficult on account of the steepness and the number of clefts, and the sharpness of the stones. When they arrived somewhat less than half-way up, they judged it more prudent to relinquish the undertaking, as the remainder of the way was much more rugged, and the ground began to grow very hot; as they descended, they observed a great deal of smoke and vapor rising from the holes and clefts they had left behind them. They stopped at a hole, whence issued a great deal of steam, and suspended in it a piece of the flesh of a sea-lion; after leaving it there a short time they drew it out, and found it cooked as if it had been set over a fire.

"Becoming extremely thirsty, and not finding any water

fit to drink, they were forced to return without any farther examination. . . . According to the farther testimony of the people at Oonalashka, the form and appearance of the peak vary from time to time; sometimes it seems high and pointed, looking like a vast pillar, sometimes lower and rounded at the summit; sometimes it sends forth a bright flame, at other times it only smokes, and the smoke is much greater at some times than at others. The island seems constantly to increase in circumference, and the peak in height."

Then, speaking of his own visit, Langsdorf says: "On the 17th of August, in the afternoon, we left Oonalashka, and the next day passed this new island; it is of a middling height, and rises quite to a peak. The center point has on every side the appearance of a pillar, and seems entirely perpendicular. On the northwest side are four rounded summits, which rise one above the other like steps."

On June 2, 1820, the Imperial sloop 'Good Intent,' commanded by Capt. Gleb Semenovich Shishmaref, attempted a landing at Bogoslof but was prevented by heavy breakers. Dr. Stein, who was on board, mentions seeing a herd of sea-lions at the southeastern end of the island (Cape Sarichef), and states that from the highest point of the mountain, which he named Krusenstern Vulcanus, a column of smoke arose, probably from the crater, but no fire was seen. From a cleft at the foot of the mountain came a waterfall, a bow-shaped spring. The island was then described as "a cold rock that had ceased to grow." It appeared streaked from top to bottom with clefts and gray colored lava flows. The circumference was given as four nautical miles, the height above the sea as 500 feet.

Grewingk believes it attained its highest elevation in 1814, and Veniaminof states that it ceased to increase in

size about 1823. No accurate measurements were made, but its altitude in different years was variously estimated from 350 to 2,500 feet.

Lütke quotes Tebenkof to the effect that in 1832 the island was not more than two nautical miles in circumfer-

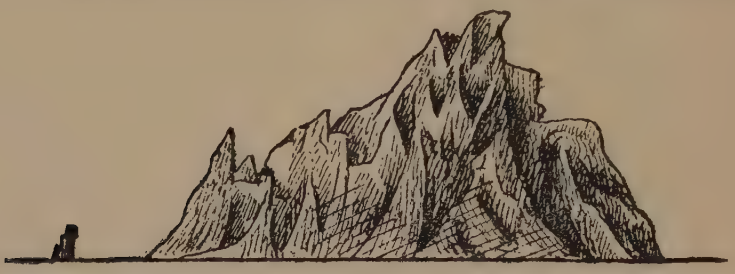


FIG. 1. TEBENKOF'S SKETCH OF BOGOSLOF AND SHIP ROCK IN 1832. FROM THE SOUTH.

ence and 1,500 feet in altitude. It was pyramidal in form, its sides covered with sharp crags which threatened to fall at any moment; the north shore was ragged; the south a steep wall from which protruded a low tongue of land on which sea-lions hauled out. A verst (⅔ of a mile) north

FIG. 2. DALL'S SKETCH OF BOGOSLOF AND SHIP ROCK IN 1873. FROM THE SOUTH.

of the island stood the high crag known as Sail Rock, which at that time had no close connection with Bogoslof.[1] Lütke's atlas contains a rough sketch of Bogoslof, made by Tebenkof, which is here reproduced (fig. 1). So far as I have been able to ascertain, this is the first published

[1] Lütke, F.—Voyage autour du Monde, etc. Nautical Part, with Atlas, St. Petersburg, p. 302, Fig. 18, 1836.

figure of the island, and no others appear to have been drawn until 1873, when Dall made six outline sketches from different positions.[1] One of these, from essentially the same point of view as Tebenkof's, is reproduced for direct comparison (fig. 2). It shows how the island had shortened and how the lofty central peak of Tebenkof (which in Langsdorf's time, 1806, was still higher and more precipitous) had weathered and disintegrated until in 1873 it was but little higher than the northwest end. This end — the one facing Ship Rock — had suffered most from the inroads of the sea. The part which in Tebenkof's sketch is capped by the first and second pinnacles had been completely torn away, thereby

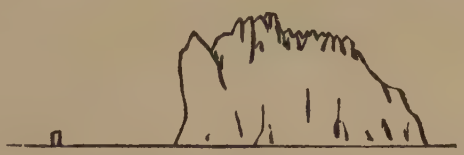


FIG. 3. BOGOSLOF AND SHIP ROCK FROM THE SOUTHWEST IN 1873. AFTER DALL.

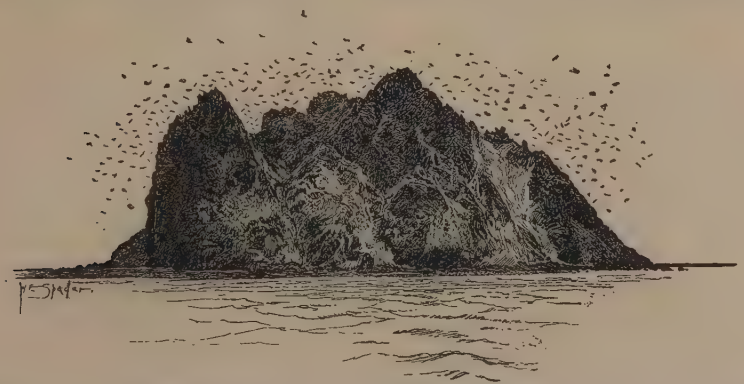


FIG. 4. OLD BOGOSLOF FROM THE SOUTHWEST IN 1884. FROM PHOTOGRAPH BY LT. G. H. DOTY OF THE 'CORWIN.'

shortening the island by about a quarter of its length. The ocean face of the northwest end, as seen in profile from the southwest (fig. 3) had already become a perpen-

[1] Dall's sketches were made with unusual care, the proportions being corrected by horizontal and vertical angles. They were published in Science of January 25, 1884.

dicular cliff, which form it has maintained to the present day. Its summit tapered to a sharp point, as shown in two of Dall's sketches (figs. 2 and 3), and the crest of the entire ridge was broken into pinnacles.

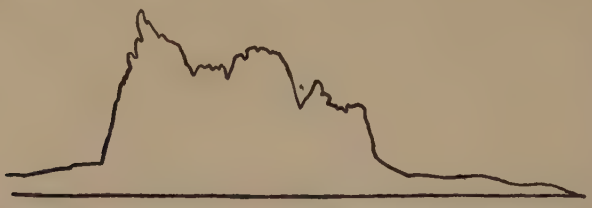


FIG. 5. MARGINAL OUTLINE OF OLD BOGOSLOF IN 1887. REVERSED FROM ROUGH SKETCH BY W. C. GREENFIELD.

In 1884, as shown by photographs taken by Lieutenant Doty of the 'Corwin' (figs. 4 and 17), the top of the northwest peak was less sharply pointed, the middle peak was still decidedly the higher, the interval between the two had so weathered as to present three notches and two prominent knobs leading up like great steps to the middle, and the series of pinnacles shown by Dall had fallen.

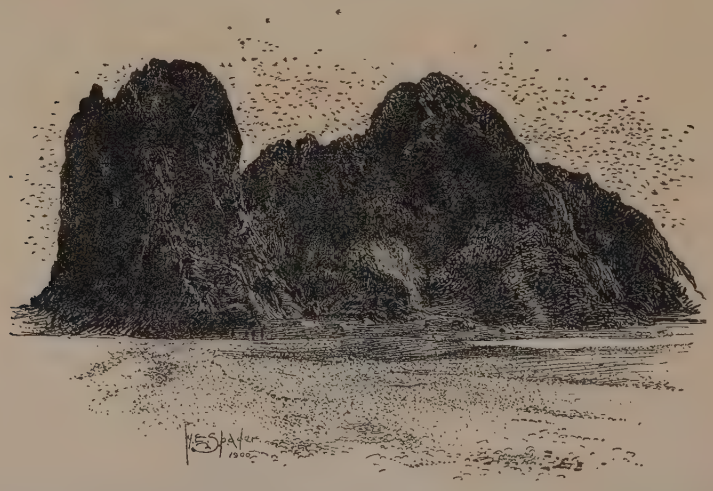


FIG. 6. OLD BOGOSLOF FROM THE WEST SPIT IN 1891. THE NORTHWEST PEAK, OWING TO ITS NEARNESS, APPEARS HIGHER THAN THE MORE DISTANT MIDDLE PEAK.

In 1887, according to a rough sketch by William C. Greenfield (fig. 5) the middle peak had crumbled until it

was lower than the one at the northwest end, and the latter was crowned by a high slender pinnacle.

In 1891, the date of my first visit, Greenfield's pinnacle had fallen, the top of the northwest peak had become a huge bluntly-rounded pillar lower than the middle peak, and the depression between the two had become a long, deeply excavated saddle (fig. 6). Seen from a distance, a sharp peak rose from this saddle (see photogravure at beginning of article).

In 1895, the date of Dall's second visit, the principal peaks had undergone much additional weathering though

FIG. 7. OLD BOGOSLOF FROM THE EAST SPIT IN 1895. FROM PHOTOGRAPHS BY C. W. PURINGTON.

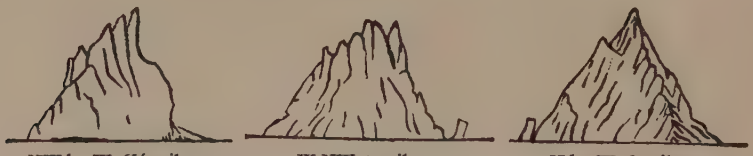
the middle peak still remained highest, and the saddle between had changed in form, as shown in figure 7.

The degradation of the peak and disintegration of the ridge throughout its entire length have been materially assisted by its extreme narrowness and sharpness. This narrowness is well shown in one of Dall's sketches (fig. 8) which gives an end view of the island. In describing it as it appeared in 1873, Dall says: "It formed a sharp

serrated ridge, about 850 feet in height, very narrow, the sides meeting above in a very acute angle, where they are broken into a number of inaccessible pinnacles. There is no crater, nor appearance of a crater. The shore-line formed a tolerably regular oval, pointed at the southeast end, having its longitudinal axis trending NW ¼ W and SE ¼ E by compass, and reaching about three-quarters of a nautical mile in length. The shores are mostly precipitous; but at the southeastern extremity the waves have accumulated a small spit or pointed bit of beach, of talus, on which in perfectly favorable weather a landing may be had. With the least swell a heavy surf is formed here. . . .

FIG. 8. END VIEW OF BOGOSLOF (FROM THE SOUTHEAST) IN 1873. BEARING NW ¼ W. DISTANCE 6 MILES. AFTER DALL.

Less than half a mile north and west from the island is a perpendicular square-topped pillar, about 150 feet high, called on modern charts 'Ship Rock.' Less than half a mile north and east from the island is a small rock rising only a few feet above the water. North, east, and south, and especially east-southeast from the point of the



NW by W. 6½ miles. W NW. 7 miles. N by W. 6 miles.

FIGS. 9, 10, 11. BOGOSLOF FROM VARIOUS BEARINGS IN 1873. AFTER DALL. IN FIGS. 10 AND 11 SHIP ROCK IS JUST APPEARING OFF THE FAR END OF BOGOSLOF.

island, scattered breakers were observed, extending less than three-quarters of a mile from shore. The crags of the main island afford the most secure refuge to thousands of sea-parrots, puffins, auks, and divers; and sea-lions *(Eumetopias stelleri)* often rest on the talus point. It is visited in spring, if weather permits, by native egg-

hunters from Unalaska; but in 1873 several years had passed since any one had been able to make a landing at the proper season. My own party attempted it unsuccessfully in 1872 and 1873."

The amount of wearing down of the middle peak and consequent lowering of the ridge as a whole between 1873 and 1890 may be seen by comparing Dall's sketches (figs. 8 and 9) with a photograph taken by the 'Albatross,' in 1890 (fig. 12).[1] The apparent thickening of the base and bluntness of the summit shown in this photograph are the natural result of the loss of the sharp apex or crest of the ridge.

In 1884, according to Cantwell, the great north cliff rose almost perpendicularly to a height of 325 feet and was in-

FIG. 12. OLD AND NEW BOGOSLOF FROM THE SOUTHEAST IN 1890. BEARING NW BY W. FROM PHOTOGRAPH BY U. S. FISH COMMISSION.

dented at the base, forming a cave-like recess which gave it the appearance of leaning to the north. The face of the cliff at that time is shown in the reproduction of Lieut. Doty's photograph facing page 308 (upper figure).

On the evening of July 8, 1899, when the Harriman Expedition visited Bogoslof, the fog rested so heavily on the summit that the form of the two highest peaks could not be completely made out (fig. 13), but the lowness of the ridge as a whole, the small size of the northwest peak, and the depth of the notch separating it from the rest of the mass, told too plainly of the rapid wasting going on and fore-

[1] For this and other photographs taken on the Fish Commission steamer 'Albatross' I am indebted to Mr. Charles H. Townsend.

shadowed the eventual destruction of the peaks, for it seems safe to predict that before the close of another century the splendid cliffs and bold headlands will have disappeared.

The way trifling disturbances hasten the general downfall was pointed out by Cantwell in 1884. He fired a rifle-shot into a flock of sea-birds, "myriads of which were perched in the clefts and niches of the rock, and when they rose small pieces of stone were detached and in turn displaced larger pieces until a perfect avalanche of stone came down the declivity, scoring great ruts in the hillside and tearing up

FIG. 13. OLD BOGOSLOF FROM POND ON EAST SPIT, JULY, 1899. FROM PHOTOGRAPH BY HARRIMAN EXPEDITION. THE TOPS OF THE TWO PEAKS ARE HIDDEN BY FOG.

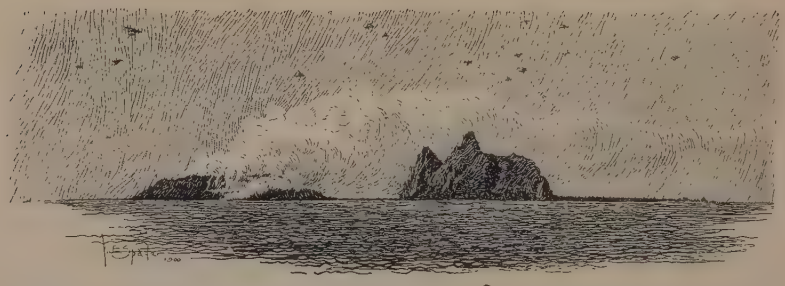


FIG. 14. THE NEW AND OLD VOLCANOES IN 1890, FROM THE SOUTHWEST. FROM PHOTOGRAPH BY U. S. FISH COMMISSION.

great masses of stone, which were dashed to pieces on the shore below." Thus even the birds may hasten the processes of nature in bringing down the mountains.

NEW BOGOSLOF OR GREWINGK.[1]

The towering cliffs of old Bogoslof no longer battle alone with the angry storms of Bering Sea, for close at hand a new island has risen. Its birth was not witnessed by human eye; no earthquake shock marked its advent, and the date of its upheaval may never be known. It was first seen by Captain Anderson of the schooner 'Matthew Turner,' on September 27, 1883, and was then in active eruption, throwing out large masses of heated rock and great volumes of smoke, steam, and ashes, which came from the apex and from numerous fissures on the sides and base, some of which were below the surface of the sea. Large rocks were shot high in the air, and falling back into the water, sent forth steam and a hissing sound. After nightfall, the vessel being then about 25 miles to windward, fire was observed on the island. A month later (October 27) Captain Hague of the schooner 'Dora' approached within a mile, passing through a streak of red water and then into a streak of green water. He is quoted as saying that black smoke, like that from burning tar, was issuing from the volcano; that it threw out flame, smoke, and red-hot rocks, and that among the sea-lions observed near by were a number which had been scalded so that the hair had come off. He thinks many were killed.

Both captains were in the service of the Alaska Commercial Company, and on their return to San Francisco were interviewed by Prof. George Davidson, who recorded in 'Science' an abstract of their statements. It appears that both vessels passed close to the new islet,

[1] Captain Hague suggested for the new islet the name 'New Bogoslof,' and Dall, in an article published in Science in January, 1884, proposed that it be named 'Grewingk' in honor of the Russian Grewingk, who, in 1850, published an important compilation of the various early accounts relating to Old Bogoslof.

approaching from opposite directions. Captain Anderson first sighted it at daybreak, September 27, and at 8:30 passed it within three cables' lengths, heaving the lead as fast as practicable with twenty fathoms of line and finding no bottom, although the water was discolored and of a reddish hue. His vessel approached from the east, stood up to the northwest, tacked ship, and passed to the westward —

FIG. 15. NEW BOGOSLOF IN FALL OF 1883. DRAWN BY PROF. GEORGE DAVIDSON FROM DESCRIPTIONS BY CAPTAINS ANDERSON AND HAGUE.

so that all sides of the volcano were seen. The captains agreed that the new island was larger than the old; that it was about half a mile northwest from it; that it rose precipitously with a rough 'ogee' curve, and that the outline of the east side was broken on the shoulder and at the base by masses of rock. Its sides were said to be very steep. Great steam jets poured out around the base.

The summit was hidden by fog or by clouds of steam. Its height above sea level was differently estimated at from 800 to 1,200 feet. From the description, Professor Davidson made a drawing representing its appearance as the captains remembered it. This drawing is here reproduced (fig. 15).

Natives of Unalaska assert that steam was observed about Bogoslof in the summer of 1882, the year before the new volcano was first seen. About the time of its appearance the two volcanoes on Akutan Island ceased to smoke and for some time showed no signs of activity. On October 20, 1883, between the visits of Captains Anderson and Hague, a shower of fine volcanic ashes or dust fell at Unalaska. The Signal observer then stationed at Unalaska reports, under date of October 22, 1883: "At 2:30 P. M. the air became suddenly darkened like night, and soon after a shower of mixed sand and water fell for about ten minutes, covering the ground with a thin layer. The windows were so covered that it was impossible to see through them."

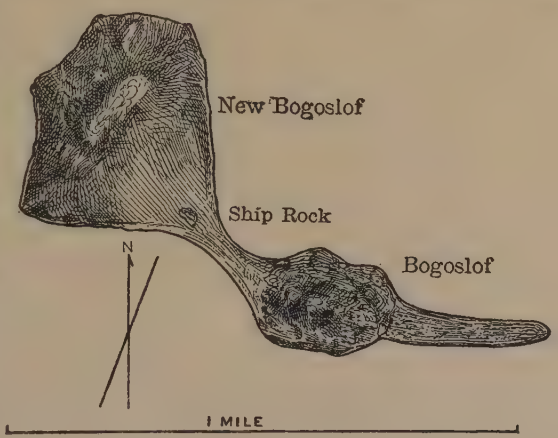


FIG. 16. CHART OF BOGOSLOF IN 1884, SHOWING THE CONNECTING SPIT OR ISTHMUS. DRAWN BY LIEUTENANT CANTWELL.

Another eye witness, a Mrs. Smith then residing at Unalaska, stated in a letter that a very remarkable black cloud appeared in the north and soon overspread the entire heavens, settling down very low and cutting off the light

of the sun. It finally broke and disappeared in a shower of ashes.

The first landing on New Bogoslof, so far as known, was made by the officers of the Revenue steamer 'Corwin' (Capt. M. A. Healy), on May 21, 1884, nine months after its discovery. Captain Healy, who from the first appreciated the importance of accurate observations and records, visited the volcano four times during the years 1884 and 1885. To his intelligent interest in the subject, ably seconded by the enthusiastic efforts of his offi-

FIG. 17. NEW BOGOSLOF SHIP ROCK OLD BOGOSLOF. FROM PHOTOGRAPH BY LT. G. H. DOTY, MAY 21, 1884, FROM THE SOUTHWEST.

cers, we owe nearly all the trustworthy information and measurements and the only photographs showing its condition and appearance, and its relations to Old Bogoslof, in the early days of its history. In his report for 1884, Captain Healy states: "Lieutenants Hall, Doty, and Cantwell, together with Assistant Surgeon Yemans, were detailed to go on shore and gather such information as they could concerning this remarkable volcano. Lieutenant Hall made a flying survey of the island, Lieutenants Doty

and Cantwell photographed several of the noteworthy features, and Lieutenant Cantwell and Dr. Yemans made various notes, which are embodied in the reports I had the honor to forward to the Department."

These reports contain reference to certain photographs and sketches additional to those published, and to a chart of the islands which likewise failed to appear in the printed document. Through the courtesy of Captain Shoemaker, Chief of the U. S. Revenue-Marine Service, the archives of the Revenue-Marine were searched and the missing sketches, including Cantwell's original manuscript chart (fig. 16), were found and placed at my disposal. Lieutenant Doty, who some time since resigned from the service, has had the great kindness to loan me his original negatives. It is hardly necessary to call attention to the importance of these records of conditions long since past and gone. Cantwell's chart and sketch 'A' (fig. 18), and some of Lieutenant Doty's photographs (figs. 4, 17, and three full page plates) are here reproduced.[1] From them, and the reports of the 'Corwin,' the condition of the islands in May, 1884, may be summarized as follows:

The height of the new volcano was 500 feet or a little less. Its upper third was cleft by a 'great fissure,' sometimes spoken of as 'the crater,' extending in a NE and SW direction and dividing the summit into two unequal parts, the northwestern of which was much the larger and higher. The eastern part was estimated to comprise only about a fifth of the mass, and its height was given as 403 feet. The summit of the larger peak was so obscured by clouds of steam that it could not be measured, but it was estimated to rise about 75 feet above the smaller one, or

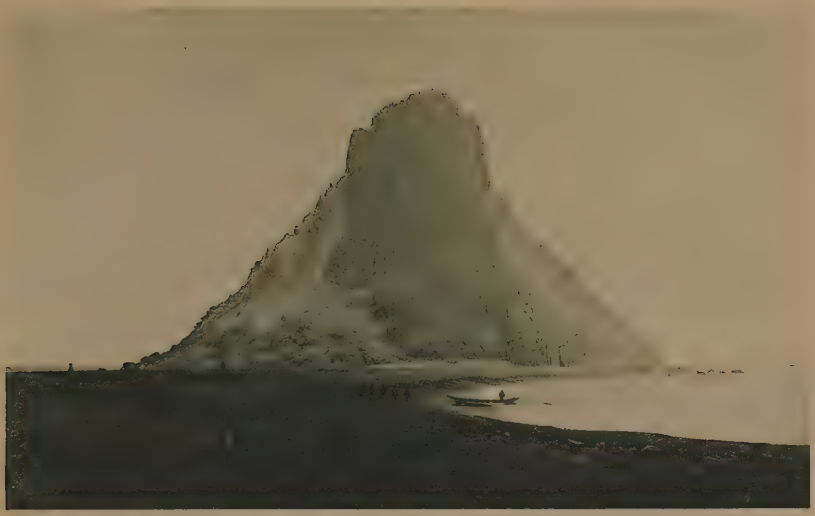
[1] It should be put on record that the data on the originals show that the points of the compass printed under the photographs of Bogoslof in the reports on the 'Cruise of the Corwin' for 1884 and 1885, are almost without exception erroneous.

at most not exceeding an altitude of 500 feet. The interior of the great fissure could not be reached or seen "owing to the steam, fumes [of sulphur], and heat rendering entrance into it highly dangerous if not impossible." The numerous steam vents were lined with thick deposits of sulphur, and the escaping steam was suffocating and nauseating. It was also found impossible to ascend the main peak. Steam and smoke "issued not only from the crater but also poured forth with great violence from rents or areas in the sides of the cone." On the northwest side Cantwell counted 15 steam jets forming a group along a horizontal line. This is shown in a reproduction of his unpublished sketch 'A' (fig. 18).

FIG. 18. NEW BOGOSLOF FROM THE NW IN 1884. FROM LT. CANTWELL'S SKETCH 'A.' ON THE RIGHT, THE END OF OLD BOGOSLOF MAY BE SEEN.

The volcano was covered with a thin layer of ashes, the surface of which, from the action of rain, had been converted into a crust. The party found it very difficult to climb the slope, sinking ankle deep to knee deep through this crust and into an almost impalpable dust, which rose in clouds and nearly suffocated them. As the first summit was reached, the heat of the ashes became almost unbearable, and Lieutenant Cantwell was forced to pick his way over rocks whose exposed surfaces were cooler and afforded a more secure foothold. The temperature of the sand at the foot of the cone was 44° Fahr., of the material halfway to the top 191°, and in a crevice near the summit was so high that the thermometer (which was made to register 260°) exploded, and the solder fastening the ring to the instrument was fused.

The old and new volcanoes were connected by a broad



OLD BOGOSLOF FROM CONNECTING SPIT NEAR NEW VOLCANO

PHOTOGRAPHS BY LT. G.H. DOTY

JOHN ANDREW & SON

NEW BOGOSLOF FROM CONNECTING SPIT AT BASE OF OLD BOGOSLOF
BOGOSLOF ISLANDS. BERING SEA
MAY 21, 1884

OHIO UNIVERSITY
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bar or spit called 'the isthmus,' which at its narrowest part was 326 feet wide. This is shown in Cantwell's chart (fig. 16) and in Lieutenant Doty's photographs (fig. 17 and plate opposite this page). From this spit, and near the base of the new volcano, rose a tower-like rock 87 feet high with a slight inclination to the north — Ship Rock (see photogravure). Barnacles and watermarks were found on the Rock twenty feet or more above sea level, conclusive evidence of recent elevation.

The general trend of the islands (or island, for at that time the two were connected by continuous land) was SE by E and NW by W.

The position of Ship Rock, from observations made by Lieut. J. W. Howison, was found to be: Lat. 53°55′18″; Long. 168°00′22″ west.[1]

Heights and distances were determined by Lieut. D. W. Hall by means of angular measurements. They are herewith appended:

	Feet.
Height of east pinnacle of Old Bogoslof	334
Height of center pinnacle of Old Bogoslof	289[2]
Height of west pinnacle of Old Bogoslof	324
Breadth of base of Old Bogoslof	933
Height of Ship Rock	87.5
Width of isthmus (narrowest)	326
Length of southern spit	1,824
Extreme length of island	7,904
Height of southeast peak of New Bogoslof	403
Height of southwest peak of New Bogoslof	475–500

The length of the connecting spit is not definitely given, but Cantwell states that on leaving the new volcano a

[1] The position of Ship Rock given by Stoney is: Lat. 53°55′56.3″; Long. 167°57′17.14″.

The position of new Bogoslof given by Tanner is Lat. 53°54′.

[2] This is obviously an error, as the photographs show that the middle peak was the highest part of the island (fig. 5). The 289 may be a typographical error for 389.

walk of a third of a mile brought him to old Bogoslof, which would give the spit a length of about 1,750 feet.

On May 28, 1884, only a week after the visit of the 'Corwin,' Lieut. George M. Stoney of the Navy arrived at Bogoslof and spent three days in taking soundings around the island. His report on the subject seems to have mysteriously disappeared, but an abstract of it was printed in 'Science' for November 7, 1884, and a brief memorandum entitled 'Sailing Directions for Bogoslof Island and Hague Island' is on file in the U. S. Hydrographic Office. Lieut. Stoney also prepared a chart on which fully 150 soundings are recorded. This chart, through the courtesy of Captain C. C. Todd, Hydrographer U. S. Navy, I have been permitted to reproduce (fig. 19). Stoney states that a thermometer inserted an inch and a half below the crust rose to 250° Fahr. in a few seconds (the air temperature at the time being 40°), and that a stick placed against the hot rock blazed instantly. Many earthquake shocks were felt on the schooner at anchor, and once, when climbing the volcano, "a most sensible vibration of the whole mass took place." "Rumbling sounds, and a dull roar similar to the discharge of distant cannon, were heard at intervals; and though flames were seen only upon two occasions, yet this is believed to have been due to the little darkness of the season at that latitude." The summit was usually hidden by masses of black and whitish smoke. "Near the base of the volcano the water bubbled and broke, as if boiling, but no

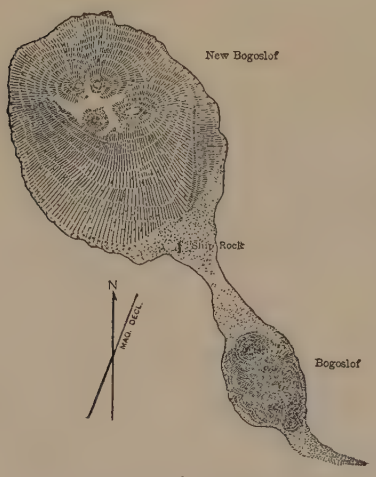

FIG. 19. STONEY'S CHART OF BOGOSLOF IN MAY, 1884.

difference was found in the surface and bottom temperatures; and at the anchorage, where the same ebullition was apparent, there was a difference of one degree only between the same points." No fishes were found near the islands, though repeated efforts were made to catch fish in the surrounding waters.

In his manuscript 'Sailing Directions' Stoney gave the rise and fall of the tide as about ten feet, and described the beach as steep, with six fathoms of water 100 feet off shore. The southwest anchorage he found much the best, having a gravel and fine sand bottom and regular soundings. The northeast anchorage was not so good, having kelp patches and rocky bottom, with irregular soundings. "The water was bubbling up all the time

FIG. 20. OLD AND NEW BOGOSLOF IN 1884. FROM SKETCH BY LT. G. M. STONEY.

while at this anchorage." The sea near the southwest side of Old Bogoslof was filled with kelp and sunken rocks.

In the fall of the same year (Sept. 10, 1884), on the return of the 'Corwin' from the Arctic, Captain Healy revisited the island. In his report he states that a number of new features attracted his attention, but does not say what they were.

The next year, 1885, the 'Corwin' visited Bogoslof twice — first on June 19, and again on September 14. Captain Healy states that its activity had somewhat lessened but the general appearance had not changed since the previous year. Both peaks were inaccessible on account of the steam and fumes of sulphur in which they

were enveloped. Leaving for Unalaska in the evening after the second visit the vessel sailed around the north end of the volcano, which in the darkness presented a most extraordinary spectacle. The summit was enveloped in a bright sulphurous light which burst forth from rifts in its side and shone out against the black sky in the background, making a scene both beautiful and impressive.

The next record is a sketch made in 1887 by William C. Greenfield and published by Becker and Dall in 1898 (fig. 21). In this sketch the new volcano is represented as considerably higher than Old Bogoslof; the two are connected by an elevated bar which appears higher than in the 'Corwin's' photographs taken in 1885; Ship Rock is still standing and of considerable height, although dis-

FIG. 21. ROUGH SKETCH OF THE ISLANDS IN 1887, BY WM. C. GREENFIELD.

integration had evidently begun; the new volcano is steaming from three principal peaks, and from a vent at the northeast corner (which in later years became the one of greatest activity); the highest peak is at the northwest corner.

Three years later (August 2, 1890) the U. S. Fish Commission steamer 'Albatross' (Capt. Z. L. Tanner) passed within three-quarters of a mile of the island, but no landing was made. Captain Tanner states that the day was unusually clear, Makushin and the highlands of Umnak being distinctly visible. Ship Rock had fallen and its original position was marked by debris. New Bogoslof was enveloped in smoke and steam so dense that its outlines could not be accurately determined, but its alti-

PHOTOGRAPH BY U.S. FISH COMMISSION

JOHN ANDREW & SON

WEST SIDE BOGOSLOF VOLCANO
Aug. 11, 1891

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tude was not far from 400 feet — that of the highest peak of Old Bogoslof being 370 feet. The islands were still connected, standing on the same platform, and their length collectively was given as a mile and a quarter (fig. 14).[1]

The following year, 1891, it was my good fortune to visit Bogoslof. Prof. T. C. Mendenhall and I were on our way home from the Pribilof Islands, whither we had been sent as Commissioners to represent the interests of the United States in the controversy with Great Britain over the fur-seals. We left the Pribilofs on the evening of August 10, on board the 'Albatross,' commanded by Captain Tanner, whom we persuaded to return to Unalaska by way of the volcano. The night was densely foggy, as usual in Bering Sea in summer, and the early morning brought no change. The ship was feeling her way cautiously with no land in sight, when suddenly, about seven o'clock, the fog lifted and we saw, directly ahead and hardly a mile away, the bold front of the new volcano. We felt a thrill of excitement as the precipitous cliffs of the northern end broke through the fog, followed by a fierce rush of escaping steam, whose roar, when the engines stopped, drowned all other noises, not excepting the cries of the myriads of seabirds which swarmed about the rocks like bees about a hive. A little farther away and somewhat to the left, Old Bogoslof soon came into view. The relations of the two are shown in the plate at the beginning of the article, which is from a photograph taken from the deck of the 'Albatross.'

Before anchoring, Captain Tanner took the precaution to send an officer in a small boat to run a line of soundings between the ship and shore. Good anchorage was reported, with nothing less than twenty fathoms. The ship was started ahead slowly, but immediately grounded on a

[1] The bearings were recorded as NW by N and SE by S (magnetic). Tanner in Report U. S. Fish Commission for 1890, pt. XVII, p. 243, 1893.

reef or rock with only nine feet of water under her bow. The small boat had crossed or gone to one side of the rock before beginning to sound.[1] We backed off without damage to the ship and anchored in the bay on the east side of the island, when a number of us went ashore in a small boat, visiting and photographing first the new, and later the old volcano.

The bar or isthmus connecting the two islands (found by the 'Corwin' in 1884 and 1885, by Greenfield in 1887, and by the 'Albatross' in 1890) had disappeared, leaving only a short spit attached to the southern end of the new volcano. From Old Bogoslof an entirely new and very

FIG. 22. NEW BOGOSLOF FROM THE LONG WEST SPIT OF OLD BOGOSLOF, AUGUST 11, 1891.

long spit had formed on the west side and extended westerly for about a mile, leaving an open channel about a quarter of a mile wide between the two islands (as shown in fig. 22 and also in my chart, fig. 23).

The shape of the island did not in any way suggest a volcano, there being no cone and no true crater. The highest point was on the north, where the mountain rose

[1] This may have been the remains of a small rock shown on Sarychef's chart in 1826, and mentioned by Dall in 1873, as "half a mile north and east of the island [Old Bogoslof], which rises only a few feet above the water."—Dall in Rept. Supt. U. S. Coast Survey for 1873, pp. 115–116, 1875.

in a precipitous wall from the sea. This wall continued for some distance along the west side, forming a line of high cliffs with a narrow beach below (fig. 24); on the

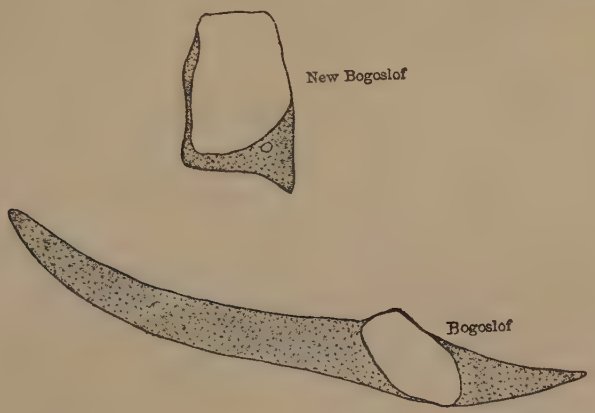

FIG. 23. SKETCH MAP BY MERRIAM SHOWING SPITS IN 1891.

east the masses of rock broke down irregularly without any beach; on the south the slope was more gradual and the island flattened down into a broad beach which stretched

FIG. 24. NORTHWEST CORNER OF NEW BOGOSLOF, AUGUST 11, 1891.

out toward Old Bogoslof — with which it was connected the previous year. On the east side, particularly a little south of the principal steam vent, the light rocks were broken

and piled in irregular masses and appeared to be undergoing movement; at all events, huge blocks had only recently toppled over and some were covered with a light deposit of grayish dust which we took to be volcanic ash.

The new volcano was enveloped in steam, which issued from thousands of small cracks and crannies and poured in vast clouds from a few great fissures and crater-like openings, the principal of which was near the northeast corner, only a few feet above high water mark. From

FIG. 25. IN THE STEAM, NEW BOGOSLOF, AUGUST 11, 1891.

this opening, the shape of which we could not see, it rushed out with a loud roaring noise. The place is shown on the right in the photogravure at the beginning of the article. So great was the quantity of steam that it completely concealed the upper part of the island except when wafted to or fro by violent gusts of wind. Professor Mendenhall and I walked from the roaring hole where this steam escaped, around the east, south, and west sides of the volcano, but it was impossible to pass around the towering cliff at

the north end. The steam was usually impregnated with fumes of sulphur, and deposits of sulphur, some in very fine needles, were observed along the margins of the cracks. Most of the rock was hot and pools of hot water were found on the beach.

Captain Tanner expressed surprise at the altered appearance of the volcano since his visit the previous year: the connecting spit had disappeared, the island had decreased in height at least 100 feet, and the pinnacle had

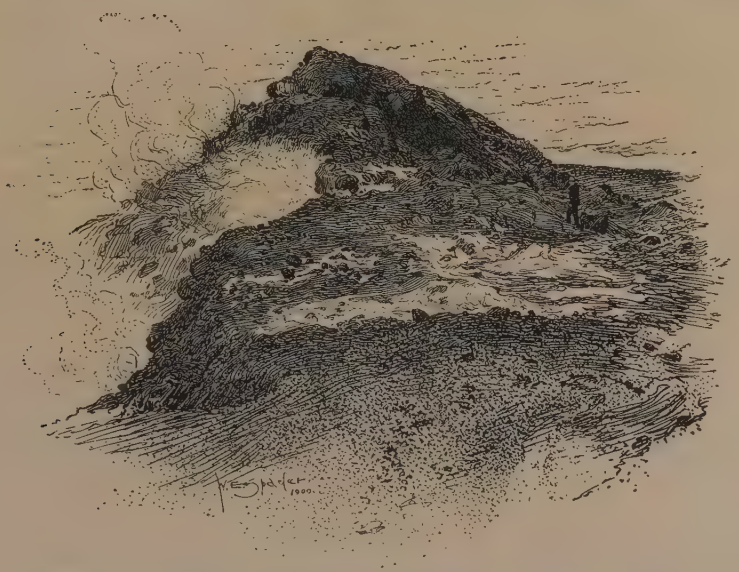

FIG. 26. SUMMIT RIDGE OF NEW BOGOSLOF, AUGUST 11, 1891. LOOKING DOWN FROM HIGHER POINT.

fallen and was lying in huge masses on the steep incline.

Two years later (1893) Captain Tanner reported the volcano "in active eruption, as usual" — by which he doubtless meant that it was steaming violently.

In 1895 Bogoslof was visited by Becker and Dall of the U. S. Geological Survey, and an assistant, C. W. Purington, took several excellent photographs, some of which are here reproduced. At this time, according to Becker,

"an apparently clean passage, nearly three quarters of a mile in width, separated the two islands [fig. 27]. The new island then appeared to be not more than some 300 feet in height. It still steamed vigorously though not violently."

FIG. 27. OLD BOGOSLOF FROM NEW BOGOSLOF IN 1895. FROM PHOTOGRAPH BY PURINGTON.

The photographs taken by Mr. Purington, particularly figure 28, show that since my visit in 1891 the activity of the steam vents had greatly diminished, and the top of the volcano had lowered and flattened down. Becker is in error in stating that this flat-topped form had been as-

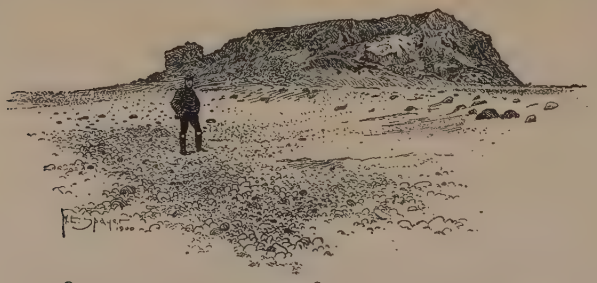

FIG. 28. NEW BOGOSLOF IN 1895 FROM THE SOUTHEAST. FROM PHOTOGRAPH BY PURINGTON.

sumed in 1891, as may be seen by comparing the plate at the beginning of this article (and also fig. 26, showing part of the summit in that year) with Purington's photograph of 1895 (fig. 28). One of Purington's photographs shows details of the west side (fig. 29) and though not from ex-

actly the same point of view may be compared with my photograph of the same side taken four years earlier (fig. 24).

In 1897 Dr. Leonhard Stejneger, while on his way to

FIG. 29. PART OF WEST SIDE OF NEW BOGOSLOF IN 1895. FROM PHOTOGRAPH BY PURINGTON.

the Commander Islands, passed close to the north end of New Bogoslof and took some excellent photographs, two of which by his kind permission are here reproduced. They show the boldness and precipitousness of this part

FIG. 30. NEW BOGOSLOF FROM THE NORTHWEST, JUNE 30, 1897. OLD BOGOSLOF IN DISTANCE ON RIGHT. FROM PHOTOGRAPH BY STEJNEGER.

of the island, and also its level top and plateau-like form, which in view of its recent mountainous character is difficult to understand. One of these photographs (fig. 30) is from the northwest, and for position is practically identical

with Cantwell's sketch 'A' (fig. 18) with which it should be compared. The other (fig. 31) is from a point a little

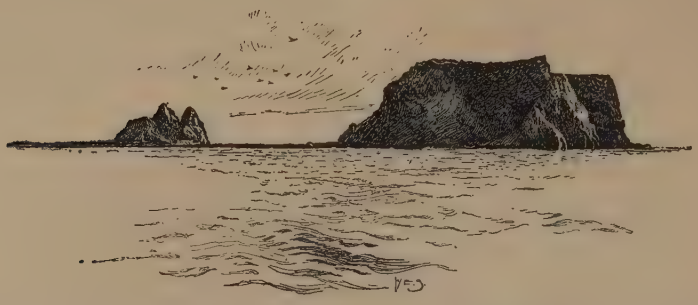

FIG. 31. THE ISLANDS FROM A LITTLE EAST OF NORTH, JUNE 30, 1897. FROM PHOTOGRAPH BY STEJNEGER.

east of north and should be compared with the photogravure at the beginning of this article.

The Harriman Expedition (1899) made no landing on New Bogoslof, but, as shown by a photograph taken from the boat by W. B. Devereux (fig. 32) the summit then

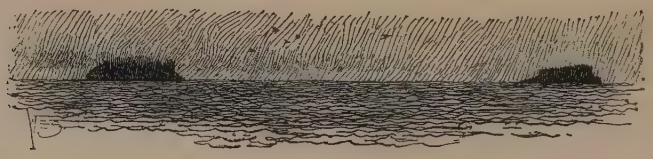

FIG. 32. THE ISLANDS ON JULY 8, 1899, FROM THE EAST. NEW BOGOSLOF ON THE RIGHT. FROM PHOTOGRAPH BY DEVEREUX.

presented the flattened form mentioned by Becker in 1895, and shown in Purington's and Stejneger's photographs.

MATERIALS.

Both islands are wholly volcanic and, according to Becker, "seem to be composed entirely of hornblende-andesite, with some included fragments of diorite." Becker (in 1895) was the first geologist to visit the islands, but pre-

viously specimens of the rocks had been brought back and reported on by Dr. George P. Merrill.[1]

SHIP OR SAIL ROCK.

The first land recorded in the vicinity of the present site of Bogoslof was a huge rock seen by Krenitzin and Levashef in 1768 or 1769 — nearly 30 years before the upheaval of the old volcano. It is shown on their map of 1780 in the form of a small profile outline surrounded by four or five crosses indicating outlying rocks (fig. 33).[2] The next record is that of Captain Cook, who on October 29, 1778, "discovered an elevated rock like a tower" near the same place. He says: "We must have passed very near it in the night. We could judge of its steepness from this circumstance, that the sea, which now run very high, broke nowhere but against it."[3] This rock is shown but not named on Cook's chart. It was afterward called Ship or Sail Rock, and the name was attributed to Cook, but I have failed to find it in his narrative.

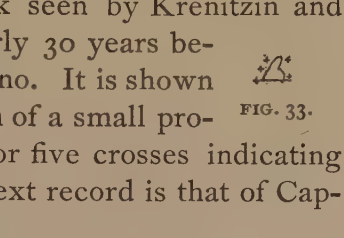

FIG. 33.

FIG. 34. KRUSENSTERN'S CHART OF BOGOSLOF AND SHIP ROCK, PUBLISHED IN 1826. (REDUCED AND RELETTERED.)

[1] Science, IV, p. 524, Dec. 12, 1884 (brief announcement). Proc. U. S. National Museum, VIII, pp. 31–33, April, 1885. Reprinted in 'Cruise of the Corwin' for 1884, pp. 45–46, 1889.

[2] Ship Rock as shown on Krenitzin and Levashef's map in 1880. Published by William Coxe in his 'Account of the Russian Discoveries between Asia and America.' London, 3d ed., 1787 [1st ed. 1780]. The sketch of the rock was reproduced (natural size) by Dall in Science, Vol. III, p. 90, Jan. 25, 1884; and (greatly enlarged) by Davidson, Ibid., III, p. 283, March 7, 1884.

[3] Voyages into the South Sea, Vol. VII (Cook's Third Voyage), p. 527, 1784. In a footnote Cook states that "though this rock had no place in the Russian map produced by Ismyloff, it has a place in the chart of Krenitzin's and Levasheff's Voyage" above referred to.

Some time after the upheaval of Bogoslof in 1796 a high rock was observed a short distance to the northward. Kotzebue states that when in Unalaska in 1817 he was told by a reliable Russian that a rock supposed to be the Ship Rock of Cook, stood about 100 fathoms north of Bogoslof. It appears in Krusenstern's chart published in 1826 (fig. 34). In 1832 Tebenkof sailed with full canvas between it and Bogoslof, and described it as a high crag rising from the sea about a verst (⅔ mile) north of the volcano.

In 1873 it was described by Dall as "a perpendicular square topped pillar, half a mile north and west of the north end of the island," and was shown in several of his sketches (figs. 2, 3, 10, 11).

In 1884, the year following the upheaval of New Bogoslof, Ship Rock was described by Lieutenant Cantwell and Dr. Yeamans as a towerlike rock 87 feet in height, with a slight inclination toward the north. It stood on the bar or isthmus which then connected the two islands, but was much nearer the new than the old volcano, as shown in Lieutenant Doty's photographs (fig. 17 and plate facing this page). The presence of barnacles and water marks twenty feet above sea level showed that it had been recently elevated; and the form of the summit, as shown in photographs and sketches made by Lieutenants Cantwell and Doty, indicates that disintregation had begun (see plate facing this page).

The next year (1885) it was apparently unchanged (Healy).

Two years later (1887), according to a sketch by Wm. C. Greenfield, it was still a prominent pillar, but its top had become very narrow and the extreme summit had doubtless crumbled away (fig. 21).

In 1890 it had fallen, and its site was marked by debris (Tanner). This debris was plainly visible at the time

PHOTOGRAPH BY LT. G.H.DOTY

JOHN ANDREW & SON

NEW BOGOSLOF FROM CENTER OF CONNECTING SPIT, SHIP ROCK IN FOREGROUND
MAY 21, 1884

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of my first visit, in August, 1891, and is shown in my photograph of the two islands at the beginning of this article. The date of its downfall was probably 1888 or 1889. Hence its known history covers a period of 120 years.

THE SHIFTING SPITS OR BARS.

The East and Southeast Spits of Old Bogoslof.

Projecting from the east side and southeast end of Old Bogoslof is a long broad spit which toward the cliffs rises in low terraces and is obviously of greater age than the other spits about the islands. While it has undergone various changes of form and extent, the character and elevation of its base show that parts of it have been in existence a number of years. The part at the southeast end, in continuation of the axis of the island, was the first to appear. It was observed by Tebenkof in 1806 and described as cold and flat, while the body of the volcano was still hot. In 1820 Doctor Stein mentioned seeing a herd of sea-lions at the southeast end. In 1832 Tebenkof described the south side as a steep wall from which protruded a low tongue of land on which sea-lions hauled out.

In 1873 the spit was observed by Dall, and its length was estimated as not exceeding one-third the length of Bogoslof — say 350 feet.

In 1884 it had grown, according to Cantwell, to measure 1800 feet, and was still confined to the end of the island. On Cantwell's chart (fig. 16) the axis of Old Bogoslof, continued through the spit, is too nearly east and west, while on Stoney's chart of the same date (fig. 19) it is too nearly north and south, its true position being intermediate between the two. Both Cantwell and Stony agree, however, that in 1884 there was no spit on the broad east (or northeast) side of the island.

In 1887, according to Greenfield's sketch (fig. 21), the south or southeast spit remained essentially as in 1884, and the drawing appears to show also a beach or spit on the east side.

In 1890, judging from the photographs taken by the U. S. Fish Commission steamer 'Albatross' (figs. 12 and 14), the southeast spit continued and the east spit had become well established. The photograph from the southeast (fig. 12) shows the high base of the east spit, but owing to the presence behind it of the north spit, connecting it with the new volcano, its extent cannot be determined.

In 1891, as seen from the 'Albatross' when at anchor just east of the new volcano, the east and south spits ap-

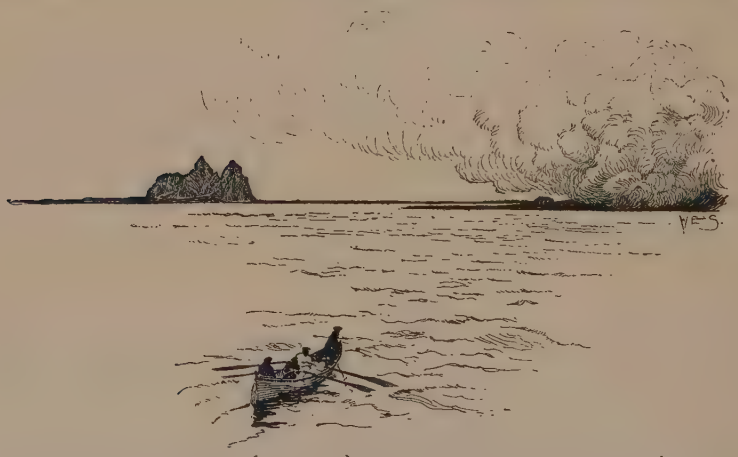

FIG. 35. OLD BOGOSLOF (ON LEFT) AND PART OF NEW BOGOSLOF (ON RIGHT) AUGUST 11, 1891. SHOWS EAST AND WEST SPITS OF OLD BOGOSLOF.

peared as one long, broad beach, rising abruptly in a terrace about midway of its length (fig. 35).

In 1895, as shown in Purington's photograph from New Bogoslof (fig. 27), which is a nearer view than fig. 35 and from a point slightly farther west, the conditions remained the same, and are more clearly shown. Another photograph made the same day (fig. 7) shows that the east spit began exactly at the base of the north cliff.

In 1899, when visited by the Harriman Expedition, no change was observed, and the length of the spit was estimated as a quarter of a mile. Mr. G. K. Gilbert's journal contains this entry: "we landed on gravel one-fourth of a mile or more from the cliff of Bogoslof and climbed two gravel scarps on the way to the cliff." A large pool was found a little back from the front of the beach (fig. 13). The fog and lateness of the hour prevented an examination of the southeast spit.

The Connecting Spit or Isthmus (1884–1890).

When New Bogoslof rose from the sea in 1883, it was unencumbered by spits or bars and the surrounding waters

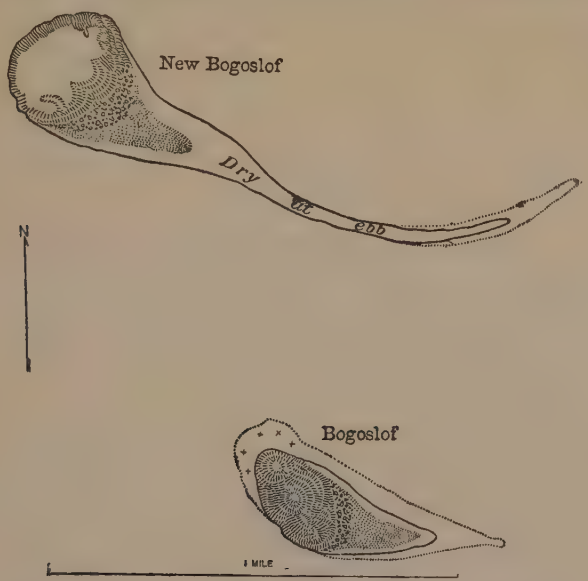

FIG. 36. DALL'S SKETCH MAP SHOWING BARS IN 1895.

were free from breakers, indicating deep water all around (fig. 15).

The following year (1884) a broad, flat spit had pushed out from the south end and reached all the way to the base of the great north cliff of Old Bogoslof, completely

connecting the two islands (see charts and photographs by Cantwell, Doty, and Stoney, figs. 16, 17, 19, 20, and plate facing p. 308).

This spit or isthmus continued until the winter of 1890–1891,[1] when it was washed away, leaving a broad water passage between the islands (figs. 22 and 23). The only vestige remaining in the summer of 1891 was the northwest end which then formed a flat beach along the south end of the new volcano (see plate at beginning of article).

The West Spit of Old Bogoslof.

In 1891 an entirely new and very long spit pushed out from the west side of Old Bogoslof and extended westerly for about a mile, curving slightly northward at the end (figs. 23 and 35). Its base was broadly attached to the west side of the island (fig. 6). The date of its destruction is unknown, but in 1895, according to Dall's chart (fig. 36), it had completely disappeared.

The East Spit of New Bogoslof.

In 1895, according to Dall (fig. 36) a new spit, dry at ebb tide, had formed on the east side of the new volcano, whence it extended easterly about a mile, its tip curving to the north.

In 1899, when visited by the Harriman Expedition, the conditions about the new volcano could not be clearly made out, owing to the fog, but from a line of breakers it was evident that a slightly sunken bar occupied essentially the position laid down by Dall in 1895, except that it curved to the southeast instead of the northeast, and closely approached the old volcano. Dall states that such spits may be formed or destroyed in a single winter storm.

[1] It was seen by the 'Corwin' in 1885 (Healy), was sketched by Greenfield in 1887, and photographed by the 'Albatross' in 1890 (and mentioned by Captain Tanner in his report for that year).

PHYSICAL HISTORY.[1]

The known history of other volcanoes makes it possible, with moderate and legitimate use of the imagination, to construct from the records here assembled the physical history of this locality. Some thousands of years ago a crack in the earth was opened deep down under Bering Sea and lavas welled out. Some of them may have flowed over the bottom as liquids until they congealed; others were doubtless burst into fragments by the expansion of imprisoned steam. This occurred, not once but many times, until at last the accumulated rock made a mountain high enough to show its head above the sea. Then the forces of the air attacked it and storm waves beat against it and it was worn and washed away, till there remained above water only a pyramidal rock with a bit of beach or spit that had been built up by the waves from the waste of the original island. It was in this condition when first seen by white men, the remnant crag being Ship Rock. In 1796 there was a new eruption, breaking out a little to one side of the last, so as to form a separate island, Old Bogoslof; and this in turn was attacked by the elements and rapidly reduced in area. Yet another eruption, in 1883, took place on the opposite side of Ship Rock, creating still a third island, New Bogoslof; all three standing on the submarine mound or mountain that previous eruptions had built.

Since then all changes, except a slight upheaval, have been wrought by storm and sea. The islands have been gnawed about the base until girt by steep cliffs. Ashes and loose rocks have been washed down to the sea, leaving the firmer masses as towers and peaks; some of these have afterwards been sapped and have fallen; and the outlines have suffered almost kaleidoscopic changes from year

[1] This note on the physical history of Bogoslof was prepared at my request by G. K. Gilbert.—C. H. M.

to year. From the abundant debris the sea waves have built large spits and bars, shifting them from place to place as each succeeding great storm came from a new direction. Storms from the northwest built out a spit from the lee of New Bogoslof till it joined the shore of Old Bogoslof, reducing the group to a single island. This spit, or isthmus, included Ship Rock and prolonged the life of that remnant by protecting it from the breakers. Then a storm from the east breached the spit between Ship Rock and Old Bogoslof and washed the greater part of it away, but built a great spit on the northwest side of Old Bogoslof; and this in turn was removed by westerly storms, which made two other spits, trailing a little south of east from the surviving islands. In 1895 there was a clear deep passage between the two, but in 1899 their ends had been connected by a submerged bar, fully half a mile to the east of the previous bar.

So rapid is the demolition of the islands that their present appearance tells little or nothing of their original forms; and their complete destruction is but a question of time. One might predict that in the next century the name Bogoslof would attach only to a reef or a shoal, were it not for the possibility of new eruptions. The pulse of the volcano is so slow that we have noted only two beats in more than a century of observation, but such sluggishness should not be taken as a symptom of death, or even decline, for volcanic organisms are characteristically spasmodic in their activity. Long before the sea has reestablished its perfect sway the arteries of the mountain may again be opened and a new and larger island put forth to contest its supremacy.

ANIMAL AND PLANT LIFE ON BOGOSLOF.

Plants.

Chamisso, in his account of the Botany of the Kotzebue Expedition, states that in 1817, according to reports, vege-

tation was beginning to appear on Bogoslof.[1] If not an error, this report must have referred to very lowly forms, for at the time of my first visit (1891) I particularly noted the absence of vegetation. It is true that I examined only the cliffs and the new spit on the west, and not the old spit on the southeast where seeds of plants have had the longest chance to grow.

When the Harriman Expedition landed on the east spit July 8, 1899, we were accompanied by one of our botanists, Mr. F. V. Coville, who made it his special business to search for plants. He found, besides an alga, only a single specimen of a small umbellifer and one or two specimens of an inconspicuous beach plant.

FIG. 37. MURRES.

Birds.

From early times Old Bogoslof has been the resort of countless multitudes of seabirds, mainly murres or 'arries,' and the new volcano had not yet cooled when the vast hordes began to take possession. At the time of my first visit (August 11, 1891) they stood by thousands on projecting points and ledges, wherever the rocks were not too hot, and hundreds of their eggs, in every stage from fresh to hatching, and young in various conditions of early growth were observed. Whether or not they relied on the warmth of the rocks to assist in incubation, and in

[1] Kotzebue, Entdeckungs-Reise, III, p. 166, 1821.

consequence remained away for longer periods than usual, was not ascertained. Many sought the steam-enshrouded crags, where, when the vapor clouds were momentarily blown aside by the wind, we repeatedly saw thousands serenely standing side by side as if enveloped in ordinary fog. It seemed remarkable that birds should voluntarily take up quarters in places where hot steam and fumes of sulphur were almost suffocating. Some, indeed, appeared to have met their death from this cause, for we picked up on the rocks below a number of dead birds that bore no sign of external injury. Lieutenant Stoney, speaking of the murres he saw about the islands the last of May, 1884, said that "such as flew into the cloud of steam and smoke of the belching volcano, as many did, immediately perished."

FIG. 38. MURRES' EGGS.

But great as were the multitudes of murres on the new volcano, their numbers were insignificant compared with those on Old Bogoslof, where every available inch of standing room was occupied. Each bird stood over its single egg, and when suddenly frightened, as by the discharge of a gun, started off, carrying its big egg between its legs, and when a short distance away letting it drop, so that the report of the gun and the launching into the air of the birds were followed by a shower of many-colored eggs.

When the Harriman Expedition visited Bogoslof on the evening of July 8, 1899, flocks of murres on their way to the islands began to pass the ship while we were still twenty-five or thirty miles away. They became more and more frequent until in a short time they formed a continuous stream.

PHOTOGRAPH BY CHICHESTER

JOHN ANDREW & SON

MURRES, OR "ARRIES", ON WALRUS ISLAND, PRIBILOF GROUP

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The fog was thick all the way — so thick that we could see only such birds as actually passed over or very close to the ship — and yet the compass showed that their course was laid direct for the volcanoes. How they found their way is a mystery not yet satisfactorily explained. As we neared the islands their numbers increased until the air was full of them, coming from different directions and all moving in straight courses to the cliffs. When finally the ship hove to, and we set out in a small boat for shore, the water was dotted with them, and some allowed us to approach so near that we almost caught them in our hands. On landing, the sea-lions became at once the objects of absorbing interest, but still we could not help noticing the great swarms of murres which continued coming to the cliffs. When one of our collectors fired his gun the multitudes that shot out into the air and circled round the island formed a dense cloud which cut off the light and made a roaring noise so loud that it drowned even the bellowing of the sea-lions. And yet, after their departure, the cliffs seemed as completely peopled as before — so inconceivably great were their numbers.

In the case of most forms of animal life the increase of the species is checked by enemies and by the limitations of the food supply, but in the case of the murres in Bering Sea, enemies are scarce, and the ocean seems to provide an inexhaustible store of food, so that the only apparent check to extravagant multiplication is the limit of available nesting places. And since the bird's requirements in this direction are easily satisfied — a shelf or point of rock three or four inches square answering every need — the numbers already attained are almost beyond belief.

Two kinds of murres are common in Bering Sea, but the six specimens obtained by me on Bogoslof, August 11, 1891, and also the six secured by Dr. A. K. Fisher on

July 8, 1899, all proved to be the Pallas murre (*Uria lomvia arra*). A few other birds are known from the islands. Two horned puffins (*Fratercula corniculata*) and a flock of kittiwakes were seen by me in 1891; and Cantwell, in May, 1884, reported puffins in great numbers, and saw also numbers of harlequin ducks, gulls, and kittiwakes, and found a dead albatross on the beach.

Sea-lions.

The only mammal known from Bogoslof is the northern or Steller sea-lion (*Eumetopias stelleri*) of which a large colony has throughout the century regularly resorted to the low ground on the southeast side of the old volcano. Langsdorf, who visited Bogoslof in 1806, was told by the native Aleuts at Unalaska that long before the upheaval of the volcano (in 1796) there had stood near the same place an isolated rock which from the time of their forefathers had always been one of the greatest resorts of sea-dogs and sea-lions.

Kriukof, Agent of the Russian-American Fur Company at Unalaska, told Kotzebue in 1817 that in 1804 a party of native hunters visited Bogoslof for sea-lions; and Baranof states that in 1814 (which date Grewingk insists is an error for 1804) a landing was made at a low place where a herd of these animals had hauled out on the rocks.

In June, 1820, they were seen by Doctor Stein, in 1832 by Tebenkof, and in 1840 were reported as abundant by Veniaminof.

The eruption of New Bogoslof in 1883 is said to have destroyed many sea-lions. Captain Hague, who visited the islands on October 27 of that year, is quoted as stating that he saw many of the survivors which had been so badly scalded that the hair had come off.

Cantwell, who explored the island very thoroughly in May, 1884, states: "Several herds of sea-lions were found

PAINTING BY CHARLES B. HUDSON.

JOHN ANDREW & SON

STAMPEDE OF SEA-LIONS, BOGOSLOF VOLCANO.
JULY 8, 1899.

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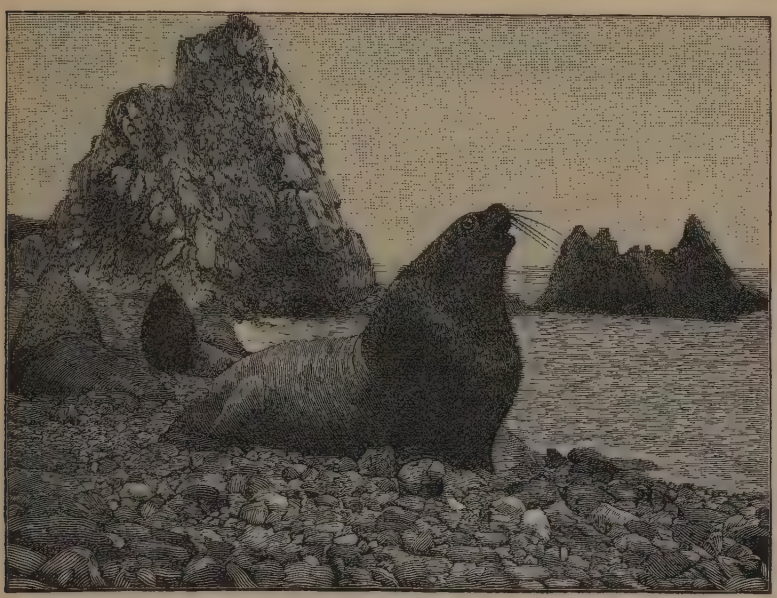
on the beaches and on the rocks of the island. They evinced no fear of our party until fired into, when they entered the water and followed us from point to point, evidently viewing our intrusion with the greatest curiosity and astonishment." Stoney, who was there a week later, found hundreds of sea-lions on the east spit and on the rocks about the base of the old volcano. They were at



SEA LIONS.

the same place when it was visited by the 'Albatross' in August, 1891.

When a boat from the Harriman Expedition carried a small party to the east spit on the evening of July 8, 1899, sea-lions were the most conspicuous and imposing objects seen. They were scattered thickly along the shore and as we drew near became restless and began to show signs of alarm. Most of the cows took to water, while the bulls bellowed and roared and moved down to the beach. Owing to the surf we were compelled to land at a particular

spot where a number of huge yellow bulls, as big as oxen and much longer, were congregated. As the boat grated on the gravel some of them came towards us, bellowing fearfully and moving in a clumsy ambling lope. While they would not turn aside to attack a man, woe betide the unfortunate who falls in their path on their mad rush to the sea! In dragging the boat up through the breakers to a safe place on shore we were careful to keep out of the way of those who had made up their minds to leave by the way we had come. Those a little farther off stared at us and roared, swinging their massive heads from side to side, and as I ran toward them with my camera, most of them took fright and made off — some into the sea, others into a pond a few rods back from shore — but a few old giants, when I was within about 20 feet of them, made a stand. I did not dispute the ground with them, but waited till they moved slowly off.

Most of the young, accompanied by more than a hundred cows and as many bulls, took refuge in the pond near shore. They were now thoroughly frightened and rushed through the shallow pool in wild confusion, making the water surge and boil and throwing the spray high in the air. Finally, as if by concerted action, all of the old sea-lions made a break for the far side of the pond and stampeded for the sea, where another absorbing scene was being enacted. Dozens of adults, apparently cows and middle aged males, were sporting like porpoises in the breakers, moving side by side in schools of six or eight and shooting completely out of the water. These small squads behaved like well drilled soldiers, keeping abreast, breaking water simultaneously, making their flying leap in the air side by side, and taking the next wave together. This they repeated again and again, evidently finding it great sport. It was a marvelous sight and one to be long remembered. Indeed our momentary stop at Bogoslof in the fog and

rain of that July evening proved one of the most interesting and exciting events of the cruise.

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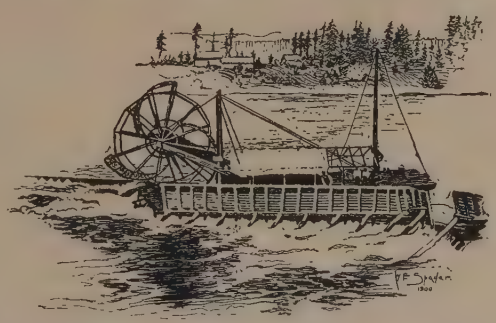
POPOF STRAIT, SHUMAGIN ISLANDS

THE SALMON INDUSTRY

BY GEORGE BIRD GRINNELL

HE fisheries of Alaska constitute one of its greatest economic resources, but they have been little exploited, except so far as the salmon are concerned. There are half a dozen species of salmon, not all of equal value.

Spending most of their time in the salt water, the salmon in summer run up the fresh-water streams as far as they can, and there deposit their eggs. Many of them die before they return to the salt water; many others are destroyed by enemies of one sort and another, and it is commonly believed by the local fishermen that after a salmon has deposited its spawn the question of its death is one of a very short time only.



SALMON WHEEL, COLUMBIA RIVER.

The world's output of canned salmon comes chiefly from our Northwest coast. In 1897 this output is said to have been not far from 3,000,000 cases, with forty eight one-pound cans to the case. Of this, Alaska produced about 1,000,000 cases.

In most salmon streams the fish appear to be about the same size and age. All the females are likely to be very similar in appearance; all the males also resemble each other. There are, however, exceptions to this rule; that is to say, some streams are entered by more than one species.

The spawning ground sought by the salmon is usually sandy or gravelly bottom in a pool or eddy, but sometimes beds are swept out and spawn is deposited where the bottom is covered with stones, varying in size from a hen's

SALMON DRYING.

egg to a man's fist. During the winter the eggs of the salmon hatch out, and in the spring after the ice passes out of the lakes the young salmon move down the streams and can often be seen at the mouths in large numbers.

It is an astonishing sight to witness the ascent of a small salmon stream by the fish, urged on by the reproductive desire. They work their way slowly up over riffles, where there is not nearly enough water to float them, but they seem to have the power of keeping themselves right side up, and so long as it does not fall over on its side, a fish six

or eight inches deep can wriggle over shoals where the water is not an inch deep nearly as fast as a man can run. On such a stream one may catch in his hands great salmon weighing ten or twelve pounds, or may kick them out on the bank with his feet. And while the appearance of a man in the shoal water will at once alarm the fish and send them darting in all directions, up or down the stream, or even out on the bank, yet they soon return, and begin again to work their way slowly up through the shallow water.

If one inquires of an individual connected with the salmon industry in Alaska something about their numbers, he is at once told of the millions found there, and informed that the supply is inexhaustible. The same language will be used that was heard in past years with regard to the abundance of the wild pigeons, or of the buffalo, or of the fur-seals of Bering Sea. But if the investigator will continue his inquiry, and ask for the details of today, he will learn that it now takes far longer to secure a given number of fish than it used to, and that the fishermen are obliged to travel much farther from the cannery than formerly to secure their catch. As the reserve of the new acquaintance wears off and he becomes interested in his subject, what he says will show very clearly that the supply of Alaska salmon is diminishing, and diminishing at a rapid rate.

The salmon in the early summer come up from the deeper waters toward the mouths of the fresh water streams, and for some weeks may be seen in the bays, inlets, and fiords collecting in great numbers, preparatory to running up the stream. At this time they may be taken in considerable numbers in such places by trolling with the hook and line, and afford good sport. At morning and evening they are seen in numbers leaping out of the water, sometimes fifteen or twenty following one another,

all leaving and entering the water almost at the same place, as if chasing one another.

When the fish have at last congregated at the mouths of the rivers, the work of the canners begins. They seldom cast their nets unless fish are actually seen, but when the salmon are visible the seine, from three to five hundred fathoms long, is swept through the water, and the captured fish are loaded on to the steam tug, which then takes them to the cannery.

The fishermen who manage the small boats and sweep the nets are either Indians or Aleuts. The crews of the steam tugs are usually white men, while the workmen on the wharf and in the cannery proper are all Chinamen, except for an occasional foreman or skilled mechanic.

After the loaded tug is tied up to the wharf, two or three men equipped with single-tined forks toss the fish from the deck to the wharf above, where they are received by other men similarly equipped, who pass them along to the gang who clean the fish at a long table. The man at the end of the table seizes a fish and cuts off its head and slides it along to the next man, who by two rapid cuts along the back takes out the backbone and loosens the entrails. It is then pushed on to the next man, by whom these loose pieces and whatever blood there may be in the visceral cavity are scraped away, the tail is cut off and the fish is thrown into a tank of water. From this it is lifted and placed with many others in a large tray, which is wheeled into one end of the cannery building. All these operations have taken place on the wharf, without the cannery and over the water, so that usually all the waste products fall down into the water below, where a part is devoured by the trout, which are constantly to be seen swimming about, a part by the gulls and other birds which congregate in great flocks near at hand, and the remainder is swept back and forth by the tide, much being carried

AT LOWE INLET, BRITISH COLUMBIA

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away, but enough left on the beach to give the place a decided odor of its own.

The tray of cleaned fish is placed at the end of a long machine, where a carrier belt, divided into compartments about 18 inches square, by wooden partitions standing at right angles to it, is constantly ascending at an angle of about 40° to the top of the machine, which is ten or twelve feet above the floor. This belt is formed of short boards linked together. The board cross partitions are not continuous, but have two or three divisions wide enough to permit heavy knives to pass down through them. Above the belt, not far from the top, is a cam in which are set a number of large knives, and this cam, revolving at the same rate with the movement of the belt, sends down a set of knives through each compartment as it moves along.

As the belt moves on, a single fish is placed in each compartment, is carried upward, is cut by the revolving knives into one-pound pieces, and when the compartment reaches the point where the belt turns to pass downward again, the fragments of the fish are thrown out on a table. All this machinery works automatically.

From the elevated table where the pieces of the fish lie, another carrier belt runs down toward another table. This belt is just wide enough to hold the one-pound fragments of fish, each of which is to fill a can. A man standing by the upper table keeps placing the pieces of fish close to each other on the belt, and they are carried downward to a point where there is a great rammer just large enough to fit into a one-pound can. This rammer works constantly back and forth across the belt carrying the fish. Opposite the rammer is a horizontal belt carrying a row of open empty cans, the mouths of which lie toward the inclined belt which carries the fish. The tin cans move at such a rate that the mouth of one is opposite the rammer at each forward motion that it makes, and at each

forward motion a one-pound fragment of salmon is jammed into an empty can, the can is carried on, and another empty can follows it, into which another piece of fish is thrust. This goes on without interruption, minute after minute and hour after hour, so long as the supply of fish holds out.

The belt carrying the filled cans now throws them out on a wide flat table surrounded by men, one of whom sets them on end as he receives them from the machine. Those that are completely full are whirled across the table to a man who with a cloth wipes the grease or moisture or salmon flesh from about the open end of the can, in order that when the cover is soldered on, the solder may take proper hold of the tin. Those not quite full are thrown to another man, at whose right hand is a pile of bits of salmon flesh. He fills the can and pushes it along to the wiper. The latter, as soon as he has finished with the can, slides it across to another who places a fragment of tin on the contents in such a position that it will be under the middle of the cover, which is now put on by another man, standing near the end of the table. The filled and covered cans are constantly gathered up and placed in trays by two men, who carry them across a short passage and set them down near a man who is attending to the soldering machine. They are laid side by side on a belt which runs down to a metal trough just as wide as a can is high and deeper at one side than at the other, the lower side being full of molten solder. The trough and solder are kept hot by a blast beneath them. The cans are moved forward by means of a heavy chain hanging over them. The belt carries the cans down to this trough. The edge of the cover where it meets the can rolls along for ten or twelve feet through this molten solder, then the can passes on to another belt, is tipped so that it stands on its bottom and rides along on the belt to a point where

men stand with trays ready to gather up the cans and carry them over to the testers, whose business it is to determine whether the cans are absolutely air tight or not. For this purpose a large number of cans are set in a strap-iron crate, which is lowered into a tank of water. If bubbles rise from any can, it evidently is not tight, and is removed and another one put in its place. In this way five, ten, or twenty cans may be taken from the crate, which is then lifted out and carried over to the great boilers, into which crates full of cans are rolled and where they are cooked by steam for an hour.

The defective cans are passed over to the solderers and by them carefully examined; the holes are soldered up by hand and the cans then go back to the testers.

After the cooking process the cans are gone over again to see whether any are defective, and then are stacked up in great piles on the floor. From these piles they are taken to racks, ranged over tanks of shellac, and when one of these racks is full, by a simple device its contents are dipped into the tank beneath, lifted out, and left there to drain. The shellac soon dries; then the cans are removed from the rack and again stacked up on the floor, where the final operation of putting on the labels is performed. When this has been done they are ready for casing, forty eight one-pound cans going into a case.

The salmon of Alaska, numerous as they have been and in some places still are, are being destroyed at so wholesale a rate that before long the canning industry must cease to be profitable, and the capital put into the canneries must cease to yield any return.

This destruction of salmon comes about through the competition between the various canneries. Their greed is so great that each strives to catch all the fish there are, and all at one time, in order that its rivals may secure as few as possible. With their steam tugs, their crews of

white men and Aleuts, and their immense seines they first sweep the waters near the canneries, and then, when these have been cleared out, go further and further away, until at present many canneries, having exhausted the nearby waters, are obliged to send their tugs 60 or 70 or even 100 miles to find fish for the pack. The fish are caught with seines, some of which are 300 fathoms long, some 450 fathoms, and I was told of one 750 fathoms long and 18 to 20 feet deep. These seines are run out near the mouths

ALEUTS DRYING SALMON AT UNALASKA.

of the rivers where the fish are schooling preparatory to their ascent, and of course everything within the compass of the net is caught. Not only are salmon taken by the steamer load, but in addition millions of other good fish are captured, killed, and thrown away. At times also it happens that far greater numbers of salmon are caught than can be used before they spoil. A friend told me of the throwing away of 60,000 salmon at one time near a cannery in Prince William Sound in the summer of 1900,

and again of the similar throwing away of 10,000 fish. At these particular times the salmon run happened to be very heavy, and more were caught than could be consumed by the cannery. So something like 700,000 pounds of valuable fish was wasted.

One of the best known salmon districts of Alaska may be chosen as an example of what this wasteful method will do for any river. I was told recently by a person very familiar with the canning industry and with Alaska that the catch of salmon in the Kadiak and Chignik districts — which put up nearly 44 percent of all the Alaska canned salmon — for 1896 was nearly 360,000 cases; for 1897 it was about 300,000 cases; for 1898, 90,000 cases, and that up to midsummer in 1899 the fishing had been practically a failure. And what is going on in the Kadiak district is going on in other districts. Competition is so very sharp between the great canning companies, as well as between the smaller individual concerns which run canneries, that each manager is eagerly desirous to put up more fish than his neighbor. All these people recognize very well that they are destroying the fishing; and that before very long a time must come when there will be no more salmon to be canned at a profit. But this very knowledge makes them more and more eager to capture the fish and to capture all the fish. This bitter competition sometimes leads to actual fighting — on the water as well as in the courts. A year or two since, one company which was trying to stop another from fishing on ground which it claimed as its own, sent out its boats with immense seines, and dropping them about the steam launches of its rival tried to haul them to the shore. This action led to long litigation, which resulted in a verdict for the company attacked.

Thus the canners work in a most wasteful and thoughtlessly selfish way, grasping for everything that is within

their reach and thinking nothing of the future. Their motto seems to be, "If I do not take all I can get somebody else will get something."

Congress has passed laws governing the taking of salmon in Alaska, but they are ineffective and there is scarcely a pretense of enforcing them. It is true that each year inspectors are brought up on the revenue cutter to see that the law is obeyed, and of course these in-

SALMON BARRICADE.

spectors see very clearly that it is violated in every direction. Where the violations are so flagrant that they force themselves on the inspectors' notice the canners are told that they are doing wrong, and that the violations of the law must cease. The canners reply to them, "Yes, we know you are quite right; it is wrong. We do not wish to do as we are doing, but so long as others act in this way we must continue to do so for our own protection. Speak to our rivals about this. We will stop if they will."

The rival companies, when spoken to, make the same reply; so accusations are bandied back and forth. Nothing is done and the bad work goes on.

Nor are the concerns satisfied with capturing the vast quantities of fish as they are schooling in the salt water preparatory to running up the streams to their spawning ground. To do this systematically would be to catch most of the fish, but it would not catch them all — it would not make a clean sweep. So, on many of the streams the companies build dams or barricades, designed to prevent any fish from ascending. Drawn by instinct to the mouths of the rivers, the fish crowd to them trying to ascend, pushing forward, going only in one direction, and never becoming discouraged so long as life remains. None ever turn back, and so, in the course of the summer the whole number which in the natural course of things would ascend a river finally collect at its mouth. If the nets are systematically drawn, all these fish are caught; not one escapes, and the river is absolutely despoiled of breeding fish for that year. Not one ascends, and so no eggs are deposited and no fry are hatched the next spring.

Of course this absolute obstruction of the streams is practicable only on the smaller rivers. But it is carried on to a greater or less extent all through the Territory wherever it can be done, and yet "the erection of dams, barricades, fish wheels, fences or any such fixed or stationary obstructions in any part of the rivers or streams of Alaska . . . is declared to be unlawful," and is punishable by a fine not exceeding $1,000 or imprisonment at hard labor for a term of 90 days, or by both such fine and imprisonment, and by a further fine of $250 per day for each day that such obstruction is maintained.

There are certain rivers too large to be barricaded, and up these some fish run, notwithstanding the continual netting at their mouths. Such rivers often head in consider-

able lakes, where the fish spawn. It is the common practice of many of the canners to fish with nets in these lakes, and with an utter disregard for consequences to catch the fish while occupied in depositing their eggs.

As the natives of Alaska, many of them Aleuts, subsist largely on salmon, the regulations of the Treasury Department permit them to fish for food, and they are not subject to the general law which provides "for the protection of the salmon fisheries of Alaska." Advantage is taken of this liberty still further to destroy the fish. The natives catch all the salmon they wish and sell them to the canners, and this goes on indefinitely wherever the prohibition against fishing is in any degree regarded. Of course the natives, ignorant of the law, and, like the white man, eager for present gain, are glad to catch the fish and to sell them.

It must be remembered that long before the white man had come to Alaska, the fisheries on most of the streams resorted to by the salmon already had owners. For hundreds of years the Indians and the Aleuts had held these fisheries, not in the general way in which an Indian tribe claimed to possess a certain territory, but with an actual ownership which was acknowledged by all and was never encroached on. Their rights to the fisheries were as real as to the arms that they bore or the boats in which they traveled. For centuries certain families or certain clans had held proprietary rights in particular streams, and they alone could take fish from them. No Indian would fish in a stream not his own. He respected the rights of others, just as he expected others to respect his own. These ancient rights have now been taken from the natives by force, but they are still anxious to get what they can from the fishing.

On some streams it is easier to take the fish in traps than it is to stop them by means of barricades, and then

PHOTOGRAPH BY U. S. FISH COMMISSION

SALMON DRYING AT CHERNOFSKI VILLAGE, ALEUTIAN ISLANDS

JOHN ANDREW & SON

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net them from the water below the barrier. In such places traps are built with wings and low dams up which the fish can pass into a pool or lake, which at its head is dammed by an impassable barrier. When the pool is full, or nearly so, it is swept clean by the net and left empty to be filled again. Thus all the breeding fish of a season may be and often are caught.

I was told that one of the great corporations established in Alaska had received permission to establish a fish

CAMP OF NATIVE SALMON FISHERMEN, KADIAK ISLAND.

hatchery, and that the employees of this company during the day catch fish ostensibly to strip for the hatchery and at night take them back to the cannery and can them.

It is well remembered that the island of Afognak, lying just east of Kadiak Island, and in one of the richest salmon regions of Alaska, was set aside some years since by Presidential proclamation as a forest reserve. Formerly there was a cannery on this island, but it has been dis-

continued and the machinery moved away. This, however, does not make much difference in the destruction of the salmon. The streams of Afognak Island are constantly fished by means of nets and barricades, and this reservation, like some of those within the limits of the United States, is a prey to whoever may be the first to despoil it.

Within a few years there has sprung up in Alaska a new and particularly wasteful method of using salmon. This is the salting of the bellies. It is perhaps not generally known that the most delicate part of the salmon is the belly. In old times certain tribes of Indians — where the fish were sufficiently abundant — habitually cut out and dried for their winter food the bellies alone, throwing away the remainder of the fish. In various parts of Alaska the same practice is carried on to-day. Only the bellies of prime salmon are preserved, salted, and packed in barrels for shipment, the whole fish, except the belly, being thrown away. In other words only from 10 percent to 20 percent in weight of each fish is used, the remainder being wasted.

Very little capital is required to establish a saltery. All that is needed is a rough shelter from the weather, salt, barrels, and labor. On the other hand to establish a cannery requires some money, for the buildings must be of a permanent character, and more or less elaborate machinery is required. A saltery may be established almost anywhere, and may readily be moved from one place to another. The salted bellies are recognized in the market as choice food and bring good prices. Thus almost anyone may establish a saltery and the business offers especial attractions to men of small means.

Salting is practiced at various points in Alaska, one of the best known salteries being situated near Tyonek on Cook Inlet. At this particular place king salmon — known

in British Columbia and the United States as 'chinook' salmon — are used. These are the largest and choicest of the Pacific coast salmon, but they are destroyed as unthinkingly as any of the others. At other salteries the varieties known as humpback and cohoe also furnish bellies for salting.

This practice may fairly be compared with the old time method of killing buffalo for their tongues alone, and the more recent one of killing elk and deer for their hides or heads or hams. It should be stopped; but even if forbidden by law there is no hope that in the present condition of governmental affairs in Alaska the law would be other than a dead letter. When — if ever — matters in Alaska shall have become so settled that the taking of salmon shall be under governmental supervision the salting of salmon bellies, like many other abuses existing there, will be put an end to.

By the law passed June 9, 1896, now in force, entitled "An act to amend an act entitled 'An act to provide for the protection of salmon fisheries of Alaska,'" it is specifically provided:

1. That streams shall not be dammed or barricaded nor traps used on them to prevent or impede the ascent of the salmon to their spawning grounds, and that the Secretary of the Treasury shall establish and enforce such regulations as may be necessary to insure compliance with the provisions of the law relating to salmon fisheries of Alaska.

2. That salmon shall not be taken except with rod or spear above the tide water of any stream less than 500 feet in width except for purposes of propagation; that nets and traps may not be laid or set for a distance of more than one-third the width of such rivers nor within 100 yards of any other net or seine in said rivers; that no fish may be killed, except in Cook Inlet and Prince William Sound, between midnight on Friday and 6 o'clock in the

morning of the Sunday following; that no salmon may be caught in any manner or by any appliance, except by rod or spear, in any stream less than 300 feet wide between 6 o'clock in the evening and 6 o'clock in the morning on each day of the week.

3. That the Secretary of the Treasury may set aside certain streams in which no fishing may be permitted, and that he may establish close seasons to limit the duration of the fishing season, or may prohibit the fishing entirely for one year or more.

4. The appointment is authorized of three inspectors of fisheries and their salaries are named.

5. Penalties for violation of the provisions of this act are announced.

As has been said, the law in force is entirely inadequate, but it is easier to see where it fails to protect than it is to suggest amendments which shall make it efficient. Persons in Alaska interested in canneries have expressed the opinion that a tax should be laid on the output of each cannery, and that this tax should be used to support hatcheries by which the supply of salmon in the streams might constantly be renewed. It is obvious that Congress, which enacts the laws, can know but little, or nothing, about the actual necessities of the case. The present law, which provides for the appointment of three inspectors to look after a territory one-fifth as large as the whole United States, where there are no means of transportation and where every stream that is six inches deep is a salmon stream, is entirely inadequate, and in fact authorizes the throwing away of the small amount of money that is paid to each of these men. Many of the provisions of the present law are excellent so far as they go, and the chief weakness lies in the fact that no means are provided for enforcing the statute.

It is obvious that the expense of enforcing the law pro-

tecting salmon in Alaska should be borne by those who are engaged in the business of catching and selling these salmon. The canners should be taxed presumably on the output of their factories, and the revenue received from this source should be used from year to year for the purpose of restocking the streams and protecting them. It might be practicable also to lease certain streams to cer-

SALMON DRYING BY ALEUTS.

tain companies on reasonable terms, not permitting them to fish except on the streams that they have leased.

What has already been written concerns the summer of 1898 and previous seasons. Since then, there appears to have been no material change in the conditions, except that the summer of 1900 was marked by an unusually good run of salmon in certain rivers, and that certain catches were large.

The report of the Special Agent of the treasury for 1900, which become accessible while these pages were passing through the press (April 1901), shows that violations of the law by the methods already described continue, and while

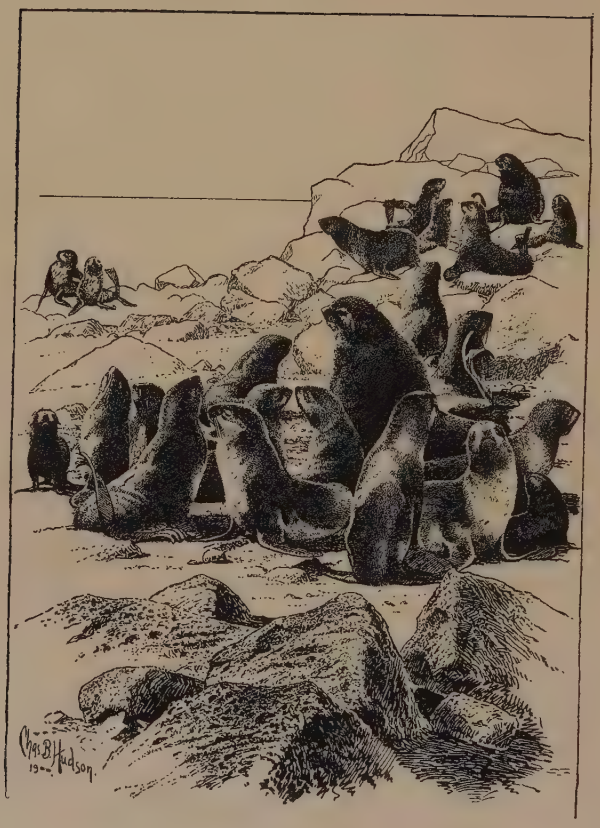
this agent takes a most cheerful view of the prospects of the fisheries and declares that many new canneries are being established — a condition which is likely always to follow a year in which there has been a good run — yet an inspection of his report indicates steady and continuous diminution in the numbers of the fish taken, and strongly emphasizes the importance of measures to increase the supply and protect the breeding fish. In describing the process of salmon taking and canning he says: "It is reported that with the help of steam power and the use of the largest size of seine as many as 75,000 salmon have been taken at a single haul. But that never happens nowadays, when a catch of 5,000 is accounted extremely good and very often a few hundred only are secured." These few words tell the whole story.

Some slightly increased interest appears to be felt in the direction of artificial propagation. The report implies that four practical hatcheries are in operation in Alaska, and says that their output of salmon fry will not exceed 14,000,000 — a number about equal to two-thirds of the annual catch. As only about one percent of these fry are supposed to mature, it is obvious that as yet the efforts to supply the annual loss caused by commercial fishing are entirely insignificant.

Notwithstanding the wholesale destruction which is thus going on, the salmon of Alaska are not in danger of actual extermination. Long before anything of this kind had taken place the canneries and indeed commercial fishing of every description would have been abandoned as unprofitable, and the streams — even those that had been most ruthlessly fished — would slowly reestablish themselves. But the selfish and shortsighted policy of taking everything in sight cannot fail to render unprofitable in a very short time the whole Alaska canning industry, and to make it necessary to abandon the costly

plants that have been established at so many points. Even if the government is too indifferent to interfere to regulate the fishing, it would seem that as a mere matter of business policy the corporations and individuals interested in the industry would get together and devise plans for their own protection; but small jealousies and the fear of being overreached by competitors have hitherto prevented this.

The question of the protection of these fisheries is not one of sentiment in any degree. It is a question as to whether the material resources of Alaska are worth protecting. Beginning twenty years ago in a very small way Alaska has produced up to this time about 7,500,000 cases of salmon in addition to large quantities that have been salted — in 1897 15,500 barrels. The output of the salmon canneries according to the official report of the U. S. Treasury Department was in 1899 valued at $3,850,346; in 1900 $6,219,887. Certainly such a resource is worth saving and making perpetual.


Chas. B. Hudson.
19--

FOX FARMING IN ALASKA

BY M. L. WASHBURN

FOR many years the world's supply of fine furs has been steadily decreasing. The beautiful sea otter, from the greed of the white hunter with his far-reaching firearms and his still more deadly net, set in the rocky passes through which the otter swims from one feeding ground to another, is practically extinct. The vast herds of fur-seals, by reason of the destructive effects of killing at sea, have so decreased that only small remnants now frequent the rookeries of the Commander and Pribilof Islands. On land the onward march of civilization just as surely proclaims the early commercial extinction of the silver fox, the blue fox, the American sable, and many less valuable fur-bearing animals. Even today so scarce have these animals become that we find comparatively few of their pelts offered in the markets of the world. Their place is largely taken by inferior skins, colored to imitate the fashionable furs of the season, but which change their tint with use until they finally return to the original hue of the creature from which they were taken — in most instances the humble rabbit.

Something like fifteen years ago a few men in western Alaska, realizing that fur-bearing animals were doomed,

decided to try the experiment of propagating some of the more valuable kinds. Having resided on the Seal or Pribilof Islands and observed that the blue fox became somewhat tame, they resolved to try its domestication by placing a small number on protected islands and caring for them as the stockman cares for his herd of cattle or sheep. About twenty foxes were taken from St. Paul Island of the Pribilof group, and placed on North Semidi, one of the hundreds of unoccupied islands of Alaska, and thus the experiment began. The industry being new nothing was known of the habits of the animal, the care necessary for its successful propagation, or the kind of food which was likely to prove commercially practicable — for it must be nutritious, inexpensive, and palatable.

BLUE FOXES ON FOX FARM.

From North Semidi, the original 'fox ranch,' if one may employ such a term, foxes were taken to other islands along the Alaska coast and the experiments continued. The results though sometimes discouraging and not always financially successful, have shown on the whole that the animal could be raised and its valuable pelt obtained with as much regularity as in the case of the humbler domestic animals. About thirty islands are now stocked with blue foxes — all the outgrowth of the small stock of twenty foxes taken from St. Paul Island fifteen years ago.

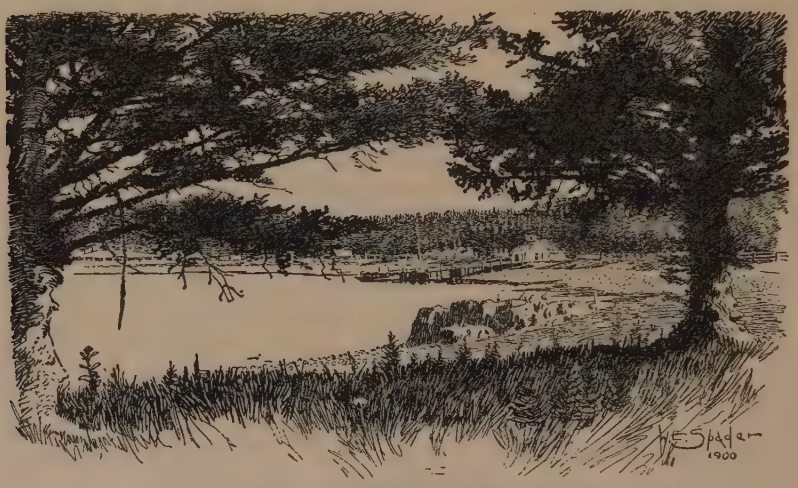
Long Island, a few miles east of Kadiak, is perhaps the ideal blue fox ranch and may serve as a type for all. It is a small island covered with grassy fields and stretches of spruce forest. Here, near the beach and nestling down in the edge of the woods, surrounded by trees, flowers, and luxuriant grasses, is the keeper's house and other buildings necessary for storing the winter's stock of food and handling the foxes during the trapping season. This station has been in operation for about five years and has now from 800 to 1,000 foxes. They are taken care of by a head keeper and two assistants. The food consists of fish and corn meal cooked together and fed to the foxes once a day throughout the year. They soon come to know the feeding time and, gathering round an hour before the food is ready, patiently wait for their daily allowance (6 or 8 ounces of meal and fish). They then scatter about the island until the time for the next day's dinner. Fish of any kind is used, either put up dry or preserved in seal oil or whale oil, the latter being especially attractive to Sir Reynard.

The foxes soon learn to recognize their keepers and show little fear of them, but, as a rule, are shy of strangers. The young are born early in May and attain their growth in about nine months. Only one litter is born each year, generally numbering from 5 to 8, though as many as 11 have been raised by one mother; this however is unusual and the estimates of increase for killing purposes are based on the probability that an average of 4 will reach maturity. During the breeding season special care is taken to scatter the food over the island as the mother does not like to leave her young for any length of time, but after they begin to run about she soon teaches them to follow her to the general feeding grounds.

The killing season is from about November 20th to January 10th, the fur being then in its finest state. The

foxes are taken in box traps and the best of each sex are saved for breeders, care being taken to mark them by clipping the hair on the end of the tail as they are released from the traps. Daily records are kept of the number of males and females released and the number of males and females killed — the reasons for killing the latter being carefully stated.

The Semidi Propagating Company, besides stocking from North Semidi, Long Island, and Chirikof for itself, has sold enough live foxes to stock the islands of Pearl, Little Naked, Goose, Green, Demidof, Deranof, and



FOX FARM, LONG ISLAND, NEAR KADIAK.

Ugak, from which in turn several other islands in eastern Alaska have been supplied, while in western Alaska four of the Shumagin islands have been stocked from Attu, where the blue fox in the wild state is still found in limited numbers.[1]

All of the islands kept by the Semidi Propagating Company, and many of the others in Alaska devoted to the

[1] In 1898 a few pairs of foxes from Long Island were sent to Foxcroft, Maine, and placed in wire-fenced yards. The animals were all pups of that season but I am informed that several foxes were raised in 1899.

breeding of foxes, are leased from the United States for this purpose and much interest is being taken by Government officials in the results of the experiments. The natives of Alaska also are beginning to realize the possibility of preserving at least a few of the fur-bearing animals and now four of the islands devoted to blue foxes are owned wholly or in part by natives who have become interested in the industry through the reports of their friends and relatives employed in caring for the animals on other islands. The natives by nature and experience make first-class keepers and through these positions obtain a good living for themselves, while rendering excellent service to their employers.

In addition to the localities referred to above, fox raising may be said to be in operation on at least one of the Pribilof Islands, which furnished the original parent stock. For many years the natives of these two islands, St. Paul and St. George, which compose the group, trapped the foxes during the winter season irrespective of sex, and sold the skins so obtained for a nominal price to the company holding the sealing lease. In recent years, however, the work has been carried on in a more systematic manner and yields much larger returns. At the present time the corporation leasing the islands, The North American Commercial Company, also leases the right from the United States to purchase all blue fox skins obtained, at the rate of $5.00 per skin, which income is devoted as a community fund to the support of the natives and is disbursed to them under the direction of the Treasury Department. This became necessary by reason of the great decrease in the seal herd with its resulting diminution of revenue to the natives. The amount so contributed is somewhere between $3,000 and $4,000 per annum. The Company, under the lease, takes entire charge of the fox business just as it does of the taking of sealskins.

The business is carried on only on St. George Island, and as now conducted is the result of several years of experimenting by the Company. A suitable house has been erected on St. George for storing food and skinning the foxes. Adjacent to this is a large square enclosed with wire netting, where the foxes are fed and the selection of males for killing is made. Only a few females are killed, the Company proceeding on the basis of the belief that the foxes are polygamous. It has been found, here, as elsewhere, however, that this view is not fully sustained

FOX CAGE-TRAPS, FOX FARM NEAR KADIAK.

by experience, for, although females have not been killed on St. George Island for several years, there is no very perceptible increase in the size of the herd.

The food used is cooked meal and fish and salted seal meat, the latter being freshened before giving it to the foxes. Owing to the vast number of birds which frequent the island it is only necessary to feed the foxes during the severe weather of the winter months. White foxes now and then appear on the islands and are shot wherever found to avoid the injurious effects of admixture with the blues.

A marked difference exists between the habits of the foxes on St. Paul and St. George islands and materially affects the question of their cultivation. On St. George they flock around the village in winter and seize greedily any articles of food lying about and, as previously noted, are quite tame and readily handled in the large wire cage. On St. Paul they are rarely seen about the village and the carcasses of mules dying in the winter have remained untouched. Nor has it been possible to induce them to congregate at any fixed place, even by scattering dried fish about. The result is that although much study has been given the matter, no system has yet been devised of cultivating the foxes or handling them on St. Paul Island except by using steel traps, which destroy male and female alike; this necessitates limiting the catch so as not to encroach too closely on the breeding stock. The difference in habits on the two islands presents a problem which has not yet been solved, nor has the further fact been explained fully that although on St. George Island the foxes have received abundance of food and the females have been carefully protected, there has been no appreciable increase; on the contrary, as compared with olden times, there has been a diminution. At present, the total catch ranges from 600 to 800, while in former years it was often twice that number. The suggestion, which has much force, has been made by Mr. J. C. Redpath, a competent observer of twenty years' experience on the islands, that many foxes are carried off and lost on the ice, which in recent years has annually floated down from the north and surrounded the islands.

In addition to the experiments in raising blue foxes which it has carried on, the Semidi Propagating Company has attempted to domesticate the beautiful silver-gray fox. Several years ago this company, in connection with two local men of Boothbay, Maine, purchased Outer Heron

Island, situated about sixty miles northeast of Portland, Maine, and stocked it with Alaska silver-grays. These foxes have shown some increase, but the difficulty of catching them in traps not destructive of life has prevented the obtaining of definite information concerning them. Although the pelt of the silvery-gray is far more valuable than that of the blue fox, being worth from $100 to $200 for reasonably good skins, and rare specimens of the dark variety bringing fabulous prices, still the belief among the owners of the fox islands seems to be that the blue fox is the more profitable for breeding purposes. They are more easily domesticated and are not afraid to go into the box trap which it is necessary to use to catch them without harm; while the silver-gray, though getting reasonably tame so far as coming to the feeding place is concerned, absolutely refuses to go into any door which might be shut on it, or enter any kind of a visible trap, and the male has the reputation of killing the young pups if he finds them unprotected by the mother, which must, from time to time, seek food for herself and young, so that thus far the raising of silver-gray foxes has not been a success where the foxes have been allowed to run together at large. Several successful experiments, however, have been made with the silver-gray foxes in small yards where the females could be separated at the season of bringing forth their young.

It had previously been supposed that foxes were polygamous and, until recently, about one male has been reserved for every five females; but the Semidi Propagating Company is now making experiments at two of its stations with a more equal division of the sexes, and the National Zoological Park at Washington, D. C. is also making experiments in the pairing of foxes and in the use of foods, which may lead to valuable results. A dozen blue foxes taken from the station at Long Island are kept in wire-fenced

yards in the park and it is expected that as a result of the investigations now going on not only will the beautiful blue foxes be preserved, but the domestication of many other fine fur-bearing animals that must otherwise soon become extinct will be attempted. It is believed that the time is not far distant when hundreds of the now useless islands of Alaska will be utilized in the propagation of fur-bearing animals, and that many of the farmers of the northern states will have wire-fenced enclosures of an acre or two devoted to this industry, from which they will reap a far greater return than from all the rest of their live stock.

Furs, being luxuries, are the most variable of all commodities in their market values. The skins of the blue fox furnish no exception. Again, their value is largely dependent on quality, and the variation in quality among skins is very great. They may be said to range in value from $5 to $50 — these two prices being the extremes; the latter is only paid for skins of unsurpassed excellence.

NOTE.—On July 16, 1899, Mr. M. L. Washburn, author of this article and one of the founders and principal owners of the Semidi Propagating Co., conducted a party consisting of Mr. and Mrs. E. H. Harriman and other members of the Expedition, from Kadiak village to the fox farm on Long Island — about an hour's sail in the naphtha launches. The buildings and grounds were inspected and a few old foxes were seen on the beach, and a number of young about one of the barns.—ED.

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PHOTOGRAPH BY CURTIS

Eskimo Settlement, Plover Bay, Siberia

D. SON BOSTON

THE SONG OF THE INNUIT[1]

BY WILLIAM H. DALL

Oh, we are the Innuit people,
  Who scatter about the floe
And watch for the puff of the breathing seal,
  While the whistling breezes blow.
By a silent stroke the ice is broke,
  And the struggling prey below,
With the crimson flood of its spouting blood
  Reddens the level snow.

Oh, we are the Innuit people,
  Who flock to the broken rim
Of the Arctic pack where the walrus lie
  In the polar twilight dim.
Far from the shore their surly roar
  Rises above the whirl
Of the eager wave, as the Innuit brave
  Their flying lances hurl.

[1] Innuit is the name by which the Eskimo calls himself and his people from Greenland to Mount St. Elias. The topek is the winter house of turf and walrus hide, as contrasted with the igloo or snow-house, used where there is no wood. All Innuit believe in evil spirits which dwell inland from the shores; in Greenland they are supposed to inhabit the Nunataks or peaks which rise like islands out of the bosom of the glaciers. In times of starvation Innuit ethics allow a mother to expose an infant, for whom she cannot supply food, in the snow to die. The child's mouth is usually stuffed with grass, as otherwise its spirit would return and be heard crying about the house at night.

Oh, we are the Innuit people,
  Who lie in the topek warm;
While the northern blast flies strong and fast,
  And fiercely roars the storm;

Recounting the ancient legends,
  Of fighting, hunting, and play,
When our ancestors came from the southland tame,
  To the glorious Arctic day.

There is one sits by in silence,
  With terror in her eyes:
For she hears in dreams the piteous
      screams
  Of a cast-out babe that dies —
Dies in the snow as the keen winds
      blow,
  And the shrieking northers come
Of that dreadful day when she starv-
      ing lay,
  Alone in her empty home.

Oh, we are the Innuit people,
And we lie secure and warm,
Where the ghostly folk of the Nunatak
Can never do us harm.
Under the stretching walrus-hide,
Where at the evening meal
The well-filled bowl cheers every soul,
Heaped high with steaming seal.

The Awful Folk of the Nunatak
Come down in the hail and snow,
And slash the skin of the kayak thin,
To work the hunter woe.
They steal the fish from the next day's dish,
And rot the walrus lines —
But they fade away with the dawning day,
As the light of summer shines.

Oh, we are the Innuit people,
Of the long, bright Arctic day:
When the whalers come and the poppies bloom,
And the ice-floe shrinks away:
Afar in the buoyant umiak,
We feather our paddle blades,

And laugh in the light of the sunshine bright,
Where the White Man's schooner trades.

Oh, we are the Innuit people,
Rosy and brown and gay;

And we shout as we sing at the wrestling ring,
Or toss the ball at play.
In frolic chase we oft embrace
The waist of a giggling maid
As she runs on the sand of
the Arctic strand,
Where the ice-bear's
bones are laid.

Oh, we are the Innuit people,
Content in our northern
home;
While the kayak's prow cuts
the curling brow
Of the breaker's snowy foam.
The merry Innuit people,
Of the cold, grey Arctic sea,
Where the breaching whale, the aurora pale
And the snow-white foxes be.

PORT CLARENCE, ALASKA,
July 13, 1899.

INDEX

Abercrombie, Capt. W. R. 262
Abies amabilis 246
lasiocarpa 240, 246
Afognak Island, area 263
forests 244
salmon 349–350
Afterglow 280, 286
Aghileen Pinnacles 88
Agriculture 271
Air, elementary facts 279–289
Akutan Island 169, 305
Alaska, area 257–258
boundary 33, 198, 241
climates 267–272
forests 235–256, 272
history 185–204
population 273–274
resources 274–276
scenery 276–277
Alaska Commercial Co. 81, 185, 303, 305
Alaska Peninsula 86–87, 88–89, 121, 133–134, 257, 264
natives 168
trees 236, 237, 244, 245
volcanos 88, 284
Alaska or yellow cedar (*Chamæcyparis nootkatensis*) 247
Albatross following ship 64
'Albatross,' U. S. Fish Commission Steamer 312, 324, 332
Alder, Oregon (*Alnus oregona*) 247, 249
Alder, shrubby (*Alnus sinuata*) 63, 83, 219, 222, 225, 249, 251, 252.
Aleutian Islands 79, 133–134
Aleutian Islands, fortified posts 196
natives 167–170
surveys 200
treeless 236, 244
village 169
Aleutian sandpiper 111
Aleutian song sparrow 80, 225
Aleuts 165, 167–170, 189
Alexander Archipelago 127, 128–129
forests 235, 244, 246
Aliutorski Islands 188
Allen, Lieut. Henry T. 240, 241
'Alpine glow' 287, 288
Alpine hemlock (*Tsuga mertensiana*) 247, 252
Alpine meadow 220–221
Alsek River 260
Altitude of timberline 241
Amherst Glacier 70
Anadyr River 186
Anderson, Capt., Discovery of New Bogoslof volcano 303–305
Anemone, yellow 106
Annette Island 24, 152–155
Antarctic glaciers 124, 259
Anvik 199
Arborvitæ or red cedar (*Thuja plicata*) 247, 272
Arctic explorations 198, 199
fox, 232
terns 71, 217, 218, 220
tundras 205, 225, 231, 232
twilight, 281
Arteaga, early explorer 190
Aruncus 250

Asia 99, 100, 102, 187
Aspen 239
Atlantic cables 201, 203
Atmosphere of Alaska 279–289
Attu Island, blue fox 360
Auk Glacier 121
Auk, little 98
Auklet, least 227, 228, 231
  paroquet 233
Auklets 109, 227
Avalanches 23, 256, 302

Baird Glacier 121
Bald eagle 20, 21, 29, 207, 226
Balm of Gilead 251
Balsam fir 240
  poplar 239, 250
Barabara 169, 170
Baranof 185, 192, 194–195, 196, 292
Barbour 195
Barnard, Lieut., killed 200
Barry Glacier 71–73, 74, 126
Bear, Kadiak 79, 85, 87
Becker, George F. 212, 317, 320, 335
Bedford Pim, explorer 200
Bees, wild 106
Belkofski 89
Bergs 123, 124, 125, 131
  blue 37, 38
Bering Sea 94, 196, 264–265
  absence of glaciers 134
  absence of trees 243, 272
  birds 227, 230, 231
  climate 270
  fogs 270, 271
  islands 89, 264, 265, 291–336
  tundra 236
Bering Strait 102, 187, 200
Bering, Vitus, expeditions 185, 187–188
  death 187–188
Birch canoes 237
Birch, paper-barked 236–237
Birds, article by Keeler 205–234
  at Bogoslof Volcano 329–332
  killed by steam 330
  struck by engine 7
Bluebells 83
Blue foxes, 114, 357–365
Bogoslof Islands 94–95
Bogoslof, article by Merriam 291–336
  bars or spits 323–326
  birds 94–95, 329–332
  Grewingk 303–320
  materials 320
  New Bogoslof 303–320
  Old Bogoslof 291–302
  plants 328–329
  physical history 327–328
  principal papers 335–336
  sealions 95, 332–334
  Ship or Sail Rock 321–323
Bomb Point 75–76
Boundary 33, 198, 241
Brady Glacier 130
Brady, Governor xxiii, 50
Brake (*Pteris aquilina*) 250
Brewer, Prof. W. H. xxxiii, xxxvi, xxxvii, 18, 62–63
  article on atmosphere of Alaska 279–289
  oration 86
Bristol Bay 196
British vessels seized by Spanish 191
Bryn Mawr Glacier 69, 127
Bunchberry 221
Bumble bees 61, 106
Burroughs, John xxxiii, xxxvii, 213, 224, 226
  narrative of expedition 1–118
  poem on Lapland Longspur 91–93
  poem on Oregon Robin 84
Butterwort 221

California 196, 281, 283
Campion, moss 47
Canada grouse 221
Canneries, salmon 23, 65, 74–75, 79, 156, 341–347, 354–355
Canoe birch 239
Canoes, different types 140, 141–143, 162–164
Cantwell, Lieut., work on Bogoslof 306–310, 322, 323, 332–333, 335
Cape Fox Indian village 116–117
Cape Nome 105, 276
  population 273
Cape Uganuk 244
Captain Roys 199

Captains Bay 189
Caribou 174
Carices 253
Carrol Glacier 128
Cascade Range glaciers 119–120
Cassiope 83
Cedar, Alaska yellow 247
red or coast 247, 272
Chamæcyparis nootkatensis 247
Chernofski 169
Chickadee, long-tailed 224, 225
rufous-backed 28, 51, 118, 219
Chilkat 260
blankets 158
Chirikof 187
'Choochkies' 98, 182
Chukchi peninsula 186
natives 98, 174, 186–187
Church bells 222
Greek at Kadiak 82
at Unalaska 91
Metlakahtla 152, 155
Clarence Straits 26
Clarkia 14
Claytonia 105, 111, 112
Clearwater River 14
Climate of Alaska 267–272
of Bering Sea 270–271
of Interior of Alaska 271–272
of Pacific Coast 267–269
Clouds 279, 280, 285–286
Coal 275
Coast forest 244–253, 272–273
Coe, Wesley R. xxxiii
Cole, Leon J. xxxv
College Fiord, Prince William Sound
birds 219, 220
glaciers 69–70, 126–127
Columbia Fiord 262
Glacier 67, 76, 126, 134
River 14, 15, 192
Columbine 61
Colville River (forest) 242
Convention between Great Britain and Russia 198
Russia and United States 196
Cook Inlet 76–77, 115, 133
trees, 237, 244, 248, 256
Cook, Capt. James 190, 321, 335
Copper 68, 275
Copper River 122, 195
forests 244
mineral resources 65, 266, 275
Cormorants 109, 212
red-faced 233
violet-green 212
'Corwin,' Revenue Steamer 306, 310, 311, 312, 335–336
Cotton grass 221
Cottonwood (*Populus trichocarpa* and *P. balsamifera*) 237, 239, 249, 251
Coville, F. V. xxxiii, 18, 63, 329
Cow parsnip 60
Cowslip 231
Coyotes 9
Crevasses 43
Crillon Glacier 122
Cross Sound 135, 260
Crows, Northwest 206, 221
Curtis, E. S. xxxv

Dall, W. H. xxxiv, 18, 62, 167
article on Discovery and Exploration 185–204
ascends Yukon 201–202
Bogoslof notes and sketches 297–301, 322–323, 326, 335
poem on Innuit People 367–370
Davidson, George 303–305, 335
Davidson Glacier 30, 121
Dawson, G. M. 237
Dead glaciers 259
'Dead Horse' trail 33
Dead houses 152
Dease and Simpson survey 199
Deer 21–22, 23, 51, 140
Dellenbaugh, F. S. xxxiv, xxxvii, 19
Devereux, W. B. xxxiv, 18, 62, 320
Devil's club 23, 225
Devil's Thumb 28
Diamedes Islands 103, 186, 187, 188
Diorite 320
Directory at Irkutsk 193–194
Discovery and exploration 185–204
Disenchantment Bay 123, 126, 131, 261
Distribution of trees, 236, 253
Diving birds 212, 227
Dixon Entrance 190

Dodecatheon 69, 221, 253
'Dora,' schooner 303
Doran, Capt. Peter xxii, xxxv, xxxvi, 62, 71–72
Doty, Lieut., photographs of Bogoslof 298, 307, 309, 322
Douglas City 255, 273
Douglas fir 246, 272
Douglas Island 29
Driftwood on Hall and St. Matthew Islands 113
Drosera 253
Dryas, white-cupped 231
Duck, Harlequin 212, 229, 233, 332
  Old Squaw 234
  Eider 102
Duncan, William 24–26, 152, 153–155
Dust, cause of color in sky 279, 285
Dutch Harbor 90-91, 114
Dwarf willows 131

Eagle Glacier 121
Eagles 20, 21, 29, 207, 226
Earthquake 89, 291, 292, 310
East Cape 186
Echinopanax horridum 249, 250
Edgecumbe Volcano 50, 190
Eggs, shower of 330
Egg hunters, 300–301
Eider 102, 234
  Spectacled 230
'Elder, George W'., our steamer, officers xxxv
  provisioning and equipment 17–18
  first ship in Harriman Fiord 71–73
  Russell Fiord 261
Elk Mountains 3
Elliot, D. G. xxi, xxxiv, xxxvi, 18, 72
Emerson, B. K. xxxiv, xxxvi, 18, 63, 99
Emmons, Lieut. Geo. T. 159
Endicott Mountains 242
Epilobium 131, 216, 220, 250
Equisetum 250, 253
Eskimo 99–104, 108, 171–183
  article by Grinnell 167–183
  babies 104, 179
  burial ground 176–177
Eskimo camp, Port Clarence 102–104, 178–183
  children, 101–102, 176, 182
  clothing, 176, 182
  dismal outlook 183
  dogs 101, 177, 179, 180
  first seen 68, 167
  houses 101, 171, 175
  Innuit (song) 367–370
  Kadiak 189
  Kayak 68, 179, 180
  King Island 177–178
  labrets 177, 178, 182
  Plover Bay village 99–102
  Prince William Sound 67, 167
  St. Lawrence Island (starvation) 108
  skin boats or umiaks 100, 103, 178–179
  tattooing, 175–176
Eskimoan stock, 167, 195
Etolin Island 27
Expedition, Bering 187–188
  Harriman, members xxxiii–xxxv
Exploration, history 185–204

Farming, doubtful 271, 276
  fox, article by Washburn 357–365
Fairweather ground 190
  Range 48, 115, 135, 235, 244
    altitude 48, 52, 260.
    glaciers 52–53, 129–130
Fernow, B. E. xxxiv, xxxvi, xxxvii, 18
  article on Alaska Forests 235–256
Ferns 83, 218
Finch, Aleutian rosy 113, 226, 227, 232
  house 12
  Lincoln 209
  rosy (Hepburn) 47, 210, 215
Fiords 19–21, 122, 123, 258, 262
Fir, red or Douglas 246, 272
Firs, 246
Fish as a resource 274
  drying 114
Fisher, Dr. A. K. xxxiv, 18, 331
Fisheries, Salmon 337–355
Fish hooks, primitive 139
Fleur-de-lis 83, 222, 253

Flora, meeting of Atlantic and Pacific 237
Flycatcher, Arkansas 12
Fog 269–271, 289
in Bering Sea 98, 107, 108, 112, 270–271
Forests, article by Fernow 235–256
article by Gannett 272–273
buried 44, 45, 130, 251
coast 23, 244–253
composition 246–247
destroyed by glaciers 52–53, 130, 251–252
economic value 243, 253–256
meeting of Atlantic and Pacific 236–237
of interior 239–243
Forest fires 118, 256, 284
Forgetmenots 83, 102, 222
Fort Kolmakoff established 198
Macpherson 199
Selkirk 202
Wrangell, 27, 28, 247, 255
Yukon, 199, 202
Fox, Arctic 232
blue 113, 274
breeding 359–361, 362
food 114, 115, 359, 362, 364
farming 68, 114, 357–365
'Fox ranch,' original 358, 359
Fox sparrow, Townsend 47
Franklin 198
search expeditions 199–200
Franklin's Return Reef 198
Frederick Sound 28
Fritellarias 222
Fuertes, L. A. xxxv, xxxvii, 63
Fulmar, Pacific 114, 229, 233, 234
Fur-bearing animals 188, 274, 357
Fur-seals 96–97, 274
Fur trade 189, 190, 191

Gannett, Henry xxxiv, xxxvi, 18, 73, 76
article on Geography of Alaska 257–277
climate 267–272
forests 272–273
population 273–274
resources 274–277
Geikie Glacier 128
Geography of Alaska, article by Gannett 257–277
Geranium, wild 83
Geum calthiflorum 253
Geum, golden 221
Gifford, R. Swain xxxiv, xxxvii, 115
Gilbert, G. K., xxxiv, xxxvi, 18, 40, 62
physical history of Bogoslof 327–328
Glaciation 128–129, 134–135, 258–259
Glacier, Amherst 69–70
Auk 121
Baird 121
Barry 71–73, 74, 126
Brady 130
Bryn Mawr 69, 127
Carrol 128
Columbia 67, 76, 126, 134
Davidson, 30, 121
Eagle 121
Geikie 128
Grand Pacific 128
Grand Plateau 122
Harvard 69, 126
Harriman 73, 126, 263
Hubbard 55–56, 126, 131, 261
Hugh Miller 127–128
La Perouse 52–53, 122, 129–130
LeConte 122, 124
Lucia 252
Malaspina 63, 121, 122, 131, 135, 261
Miles 122
Morse 45–46
Muir 35–47, 126, 128, 259
Nunatak 59, 131
Patterson 28, 121
Radcliffe 69, 127
Rendu 128
Serpentine 72, 126
Smith 69, 127
Surprise 126
Taku 125
Turner 55–56, 60, 123, 131
Vassar 69, 127
Wellesley 69, 127
Yakutat 122
Yale 69, 126
Glaciers, article by Muir 119–135

Glacier moraines 37, 42, 44, 45, 46, 53, 63, 121
Glacier Bay 35–48, 123, 125, 127–129
Island, 247
milk, 63
Glaciers, ancient 128–129, 133, 134–135, 258–259
Glaciers of Glacier Bay 35–48, 123, 125, 127–129
of Holkam or Sum Dum Bay 123, 124–125
of Lynn Canal, 30, 121
of Pacific coast 119–135, 259–262
of Port Wells 69–70, 71–74, 126–127, 132–133, 263
of Prince Willam Sound, 67, 69–74, 123, 126–127, 262–263
of Taku Inlet 125
of Yakutat Bay 56–58, 126, 131
recession of 127–128
Glenn, Capt. 262
Golden plover 106, 230
Gold 275–276
seekers 34, 65–66, 114
Golofnin Bay 242
Graham Reach 22
Grand Pacific glacier 126
Plateau glacier 122
Grantly Harbor 200
Great Britain and Russia, convention 198
Greenfield, W. C. 298, 322, 324
Greek Catholic faith 193
Green River, Wyoming 5
Grenvill Channel 118
Grewingk, Constantin 292, 295, 332, 335
Grewingk Volcano 303–320
Grosbeak, Kadiak pine 61, 83, 218, 224
Grouse, Canada 221
Grinnell, George B., xxxiv, xxxvi, xxxvii, 19
the Coastwise Indians 137–165
the Eskimo we saw 167–183
the Salmon Industry 337–355
Gull, glaucus-winged 212
kittiwake 227, 229–230, 332
Point Barrow 233
Sabine 234
Gull, short-billed 220
Gulls, 71, 109, 131, 332
Gustavus Peninsula (= Point Gustavus) 40–41

Hænke Island 60
Hague, Capt. 303, 305
Haida canoes 141
Hair seal fishing 60, 158, 159, 160–165
Hall Island, Bering Sea 109–111, 230–233, 265
Hall, Lieut. 306, 309
'Hanging valleys' 258–259
'Harems' of fur-seals 96
Harlequin duck 212, 229, 233, 332
Harriman, E. H. xxv, —, 62
kills Kadiak bear 85
Preface by xxi–xxiii
Harriman Expedition, Committees, xxxvi–xxxvii
history xxi–xxxi
members xxxiii–xxxv
Harriman family xxxiii
Harriman Fiord 71–73, 76, 132–133, 263
Glacier 73, 126, 263
Harvard Glacier 69, 126
Hawkins Island 247
Haze 279, 283, 284
Healy, Capt. M. A. 306–309, 311, 322, 335–336
Heather 65, 221
Hemlock, Alpine (*Tsuga mertensiana*) 132–133, 221, 247, 252–253
Coast (*Tsuga heterophylla*) 218, 247–249, 250
Highhole, western 19
History of Alaska 185–204
Holkam Bay 123, 124–125
Homer 76
Hornblende-andesite 320
Horned puffins 233
Horses 17–18, 33
Hot Springs, Sitka 50, 252
Howling valley 38–40
Howison, Lieut. J. W. 309
Hoxhoq 152
Hubbard Glacier 55-56, 126, 131, 261
Hudson Bay Co. 192, 198, 199
Hugh Miller Glacier 127–128

Hummingbird, Rufous 118, 207–208
Humphrey, Omar J. xxiii, xxxv
Hutli 124
Huts, Eskimo 99, 171–174
Seal-hunters, Glacier Bay (cuts) 163–164
Seal-hunters, Yakutat 60, 158–159
Hyperborean Snowbird 111, 113

Ice. See *Glacier*
Icebergs 37, 38, 123, 124, 125, 131
Ice palisade 35–36, 67
plateau, vast 121–122
Iciest region 120
Ice Cape 122, 135
Iliamna Lake 237
Volcano 76, 256
Iliuliuk 91
Indian Point 102, 177
Indian River, Sitka 50, 51
Indians, article by Grinnell 137–165
baskets 143
canoes 140–143
carvings 142, 143–144, 147–150, 156–159
deserted village 116–117, 145–148
fishing 138–139, 348
food 138–139
graves 150–152
hunting 137–138, 140
Hunya (cuts) 163–164
huts 60, 158–159, 163–164
linguistic families 138
masks 149–150
Metlakahtla 24–26, 152–156
oil boxes 159–160
potlatch 144–145
Seal hunting 60, 158–165
Sitka 50, 156–158
totem poles 116–117, 146–148, 150
Yakutat 158–165
villages 116–117, 145–146, 152, 158–165
Innuit People (poem) 367–370
Insects 106
International Boundary 33, 271
Inverarity, D. G. xxxv
Iris 83, 222, 253
Irrigation 12, 13
Isanotski Volcano 90

Jacobs ladder 83
Jæger, Parasitic 218
Pomarine 218
Jægers 61, 218, 219
Jay, Steller 28, 118, 208, 219
Junco, Oregon 28, 40
Juneau 29, 115, 156, 207

Kachemak Bay 76, 137
Kadiak bear 79, 85, 87
birds 80, 83, 221–225
climate 81, 267–268
forests 80, 85, 114, 237, 244, 255–256, 272
history 189, 193, 196
Island 77–87, 114–115, 263 (area)
original inhabitants 167, 168, 189
pine grosbeak 218–224
salmon 79, 345
verdure 79, 83, 114, 133
village 79–82
Kamchatka 187, 188
Kamchatkan traditions 188
Kayak 68, 179, 180
Kearney, T. H. xxxiv
Keeler, Charles xxxiv, 63
article on Alaska birds 205–234
poem xxxix
Kenai Peninsula 263
Kennicott, Robert 200–201
Kincaid, Trevor xxxiv
King Island, 103, 177
King Id. Eskimo 177–178
Kingfisher, Belted 209
Kinglet, Golden-crowned 51, 118, 225
Ruby-crowned 217
Kittiwakes 227, 229–230, 332
Klondike 33, 34, 185, 210, 267
Koluschan stock, Indians 138, 143
Kondakoff, Stepan 85
Knik River 237
Kotzebue Sound 200, 266
Kotzebue, Otto 196, 291, 292, 336
Kowak River 242, 266
Koyukun Indians 200
Koyukuk River 266, 273, 275

Kukak Bay 78, 86–87, 244
Kuskokwim Bay 236
River 198, 266, 275
Kwakiutl Indians 152

Labrets 177, 178, 182
Lady's slipper 83, 222
Lake Bennett 34
Clark 237
Lindeman 243
Langsdorf 293–295, 332, 336
Lapland Longspur 91, 97, 111, 226, 230
poem 91–93
La Perouse 190–191
La Perouse Glacier 52–53, 122, 129–130, 252
Laramie plains, Wyoming 4
Lark-bunting 3
Larks, Shore 7
Latourelle Falls, Oregon 15
Law to protect salmon 346–347, 351–353
Lebarge, Michael 201
LeConte Glacier 122, 124
Lectures on ship 62–63
Leucosticte, Aleutian 113, 226, 227
Hepburn 210, 215
Lincoln Finch 209
Linguistic families 138
Linnet, red poll 219
Listera 250
Lituya Bay 123, 190
Long Island, fox farm 114, 115, 244, 357-360, 364
spruce grove 244–245
Longspur, Alaska Lapland 91, 110, 226, 230, 232
Loon, Black-throated 212
Lowe Inlet 23–24, 246
Lucia Glacier 252
Lumber 254, 255
Lupines 13, 61, 227
Lutke, F. 198, 296, 336
Lycopodium 250
Lynn Canal 30, 121

Mackenzie River 198, 199, 242
Magpies in Idaho 13
on Kadiak Id. 114, 225
Malaspina Glacier 63, 121, 122, 131, 135, 261
Malaspina, Spanish navigator 261–262
Massacre at Sitka 195
Meadowlarks 3, 9
Menyanthes trifoliata & cristagalli 253
Menziesia 249
Merriam, C. Hart, xxi, xxxiv, xxxvi, 18, 122, 210, 219, 221
article Bogoslof Volcano 291–336
Introduction, xxv–xxxi
Merrill, George P. 321, 336
Metlakahtla Indians 24–26, 152–156
Middleton Island 64
Milbank Sound 22
Miles Glacier 122
Mineral resources 243, 275–276
Miners 65
Mines 243, 275–276
Treadwell 29, 30, 275
Mirage 87, 286
Mohler, A. L. xxi
Moon, brightness and paleness 283–284
Moraines. See *glaciers*
Morris, Dr. L. R. xxi, xxxv, xxxvi, xxxvii
Morse Glacier 45–46
Mosquitoes 69, 87, 106
Moss campion 47
Mount Fairweather 48
McKinley 266
Palmerston 21
Rainier, glaciers 120
St. Elias 54, 115, 235, 263
San Jacinto 190
Shasta, glaciers 119
Whipple 27
Wrangell 266
Wright 46–47
Muir cabin 35
Glacier 35–47, 126, 128, 259
Muir, John xxxiv, xxxvi, 18, 36, 38, 40, 63, 73
article on Glaciers 119–135
Muller, Gerhard Friedrick 186
Multnomah Falls, Oregon 15–17
Murre, California 212, 228
Pallas 228–229, 232, 329–332
Murres at Bogoslof Volcano 329–332
behavior in fog 331

Murres' eggs 330
myriads 94–95, 109–110, 231, 329–332
Murrelet, Marbled 71, 212

Narrative of Expedition 1–118
Natives, article by Grinnell 137–183
See also *Aleuts*, *Eskimo* and *Indians*
Nelson, G. F. xxxv, xxxvii, 63
New Archangel 196
Bogoslof or Grewingk 303–320
Metlakahtla. See *Metlakahtla*
Noatak River 242, 266, 275
Nome, Cape 105, 273, 276
Nootka taken 191
North American Commercial Co. 85, 361
Northeast passage 192
North Semidi, original 'fox ranch' 358
Northwest passage 261
Nulato 199, 200, 201
Nunatak Glacier 59, 131
Nushagak, fortified post 196

Old Bogoslof 291–302
Oneonta Gorge, Oregon 15
Orca, Salmon cannery 65, 74–75, 344
Orchid 222
Oregon Robin or Varied Thrush 40, 51, 83–85, 223
poem 84
Ouzel, Water 51
Owl, Snowy 111, 232
Oyster-catchers 21, 71, 220

Palache, Charles xxxiv, xxxvi, 18, 40, 219
Pallas Murre 230, 232
Paddles (canoe) 140–141, 247
Parkas 176, 182
Passage Canal 262
Patterson Glacier 28, 121
Pavlof volcanoes 88
Pedicularis 106, 231
People with tusks 182–183
Phalaropes 20
Phyllodoce glanduliflora 253
Picea canadensis 239
sitchensis. See *Sitka spruce*
Pigeon guillemots 212, 230, 231
Pine, gray 240
Pinus contorta (or *murrayana*) 237, 240, 246, 249, 250
Pipit, or titlark 47, 59, 93, 210, 211, 214
Plains 3, 4
sagebrush 7–9
Plover Bay, Siberia 99, 101, 171–178, 183, 230
Plover, Golden 106, 230
Point Barrow 198, 199
Gustavus 40–41, 249–250
Polar bears 108, 113
Polemoniums 222, 227, 231
Popof, Peter Iliunsen 186
Island 87, 225
Poppy, yellow Arctic 98, 102, 227, 231
Population 273–274
Populus balsamifera 237, 239, 249
trichocarpa 237, 249, 251
Porcupine River 199, 241, 266
Port Clarence 102–106, 178–183
Valdez 262
Wells 69–74, 127, 262
Potlatches 144–145
Pribilof Islands, arrival 96
birds 97–98, 227
fog 271
foxes 361
fur-seals 96–97
Primrose, purple 105, 230
Prince Frederick Sound 121
Prince of Wales Island 27, 247
Prince William Sound 63–76, 132–133, 262–263
birds 219–221
forests 132, 244, 248, 253
fox farm 68
glaciers 67, 69–74, 123, 126–127
salmon cannery 65, 74–75, 344
Princess Royal Island 246
Promishleniki 187, 188
Propeller mended 74
Pseudotsuga taxifolia 246, 272
Ptarmigan 47, 71
coloration 215, 219
White-tailed 215–216
Willow 215, 219
Puffins 109, 227–228, 231

Puffins, horned 227, 228, 233, 332
Tufted 212, 227, 228
Puget Sound trees 246, 248, 254, 272
Pullen, Robert, boat journey 199
Purington, C. W., photographs of Bogoslof 317, 318, 324
Pyrola 250
Pyrus rivularis 249

Quartz, gold-bearing 29
mines 275–276
Queen Charlotte Sound 22

Radcliffe Glacier 69, 127
Rainfall 242, 268–270
Rampart House 241
Ravens in southeastern Alaska 24, 26, 51, 206–207
at Kadiak 85, 223
at Unalaska 226
Red Fir or Douglas Spruce (*Pseudotsuga taxifolia*) 246
Redoubt Volcano 76
Redpoll 223, 226
Rendu Glacier 128
Revenue-Marine 204, 307
Rhododendron, dwarf 83
Ribes 249, 250
Ridgway, Robert xxxiv, xxxvi, 18, 40, 93, 216–218
Ringgold and Rodgers exploring expedition 200
Ritter, W. E. xxxiv, xxxvi, 18, 63
Rivers, underground 12
Robin, Oregon or Varied 40, 51, 83–85, 223
Western 40, 219
Roses in bloom 114
Rubus 249
Russell Fiord 56, 58, 59, 60, 261
Russia and Great Britain, convention 198
United States, convention 196
cession 257
transfer of Alaska to United States 203
Russian-American Company 185–195, 198, 203, 291
boundaries established 198
Russian expeditions 192, 194–195
maps 201
missionaries 192
settlements in 1820 196

Sabine Gull 234
Sagebrush 4, 7–9, 13
St. Elias Alps or Range 54, 63, 115 121, 126, 132, 244, 260, 261
St. Elias, Mount 54, 115, 235
St. George Island 264, 361
blue fox 361–362
St. Lawrence Island 107–108, 186
St. Matthew Island 99, 108–113, 264–265
birds 113, 234
new fox 113
St. Michael 201, 270
St. Paul Island 96–98, 264
birds 97–98, 227, 264
foxes 358
fur-seals 96–97
Salix alaxensis and *sitchensis* 249
Salmon, article by Grinnell 337–355
on Afognak Island 349–350
barricades 139, 347–348
bellies, salting 350–351
berries 115, 116, 118, 218
canneries 23, 65, 74–75, 79, 156, 340–355
decrease from over-fishing 339, 343–344
fishing by natives 138–139, 348
industry 337–355
hatcheries 349, 354
laws 346, 351–352
method of canning 74–75, 340–343
output and value 355
salteries 350–351
seining 340, 344
source of world's supply 337
spawning ground 338, 348
traps 348–349
trolling 339
Sambucus pubens 249, 250
Sandpiper, Pribilof 234
Sand Point 87, 225
Saunders, DeAlton xxxiv, 18
Savanna Sparrow 106

Sawmills 255
Saxifrage 83, 102, 106
Scoters, White-winged 216–217
Scouring rushes, green 218
Seabirds 98, 109–111, 114, 212, 227–231, 232–233, 234
Sea Cow 188
Seal (fur) 96–97, 274
(hair), blubber 60, 159–162
hunting 60, 161–165
hunter's village, Glacier Bay (cuts) 163, 164
Yakutat Bay 158–165
oil 60, 159–161
spear 162–163
Sealions (*Eumetopias stelleri*) 94–95, 332, 334
Sealskin boots or mukluks 176
Sealskins (hair) 159, 161, 174
Seal Islands. See *Pribilof Ids.*
Sea Otter 81, 274
Seattle 118
Semides 87
Semidi Propagating Co. 360
Serpentine Glacier 72, 126
Seymour Narrows 20
Shadow, earth's 281–282
Shearwater, slender-billed 229
Sheldon Jackson Museum 156
Shelikof Strait 263
Shell heaps 169
Ship on rocks 98, 313–314
Ship or Sail Rock 297, 321–323
Shishaldin Volcano 90
Shoemaker, Capt. C. F. 307
Shoshone Falls 7–12
Shumagin Islands 87–88, 114, 167, 225, 275, 360
Siberia, our visit 99–102, 171–178
Siberian Eskimo 99–101, 171–178
reindeer 174
yellow wagtail 230
Sibiriaks 188, 189
Sierra and Coast ranges 246, 252
Sierra Nevada glaciers 119
Silene 112
Siskin, Pine 118
Sitka 48–52
Bear 140
Sitka Indians 156–158
population 273
temperature and rainfall 267–269
Sitka or tideland spruce (*Picea sitchensis*) at Glacier Bay 249–251
at Kadiak 77, 80, 83, 244–246, 248, 255–256
at Prince William Sound 133, 221, 248, 255
at Sitka 51–52, 248, 255
at Unalaska (introduced) 245–246
at Yakutat Bay 218
growing close to glaciers 252
rate of growth 250, 255–256
Sitko 156–157
Skagway 30, 31, 210, 211
population 273
Skin boats 103
Sky, aspects 279
color 286
Smith Glacier 69, 127
Snake River, Idaho 7–13, 14
Snow-bunting or snowflake, common 93, 230
Snowflake, Hyperborean 113, 230–232
Sorbus sambucifolia 249
Song of the Innuit 367-369
Spanish claim 191
vessels 190
Sparrow, Aleutian Song 225
Golden-crowned 33, 47, 83, 210–211, 214, 222, 223, 225
Sage 9
Savanna 40, 221, 222
Song 26, 40, 80, 209, 217, 222, 226
Townsend 209, 214, 217, 219, 226
White-crowned 19
Sphagnum bog 23
Spring beauty 105
Spruce, Sitka or tideland (*Picea sitchensis*). See *Sitka spruce*
White (*Picea canadensis*) 239, 240, 241, 242, 243
Stanley-Brown, J. xxiii, xxxv
Starks, E. C. xxxv
Steller Jay 28, 118, 208, 219
Manatee or Sea Cow 188
Stejneger, Leonhard 319, 320

Stikine River 260
discovered 195
Stoney, Lieut. G. M. on Bogoslof Volcano 310–311, 323, 330, 333, 336
Strawberries 115, 218
Streptopus 250
Surprise Glacier 126
Sushitna River 266, 275
Swallow, barn, 59, 225
cliff 15
violet-backed 10
white-breasted 209
Swans 108
Swift, white-throated 10

Taku Harbor 210
Indian dead houses 152
Inlet and glacier 123, 125, 260
Pass 248
Tanana River 241, 266
Tattler, Wandering 71
Tattooing 175–176
Tchukchis, 98, 182, 186
Tebenkoff 198, 296, 297, 322, 323, 332
Temperature of Bering Sea 270
of coast 267–268
of interior 242, 271–272
Tern, Arctic, 61, 218, 220
Thrush, Dwarf Hermit 47, 58, 69, 83, 224
at Kadiak 223
at Shumagin Islands 225–226
song 31, 209, 214, 217, 221, 223, 224
Gray-cheeked 107, 223, 224
at Kadiak 223, 224
Olive-backed 19, 26
Russet-backed 28, 40, 51, 210
Varied (or Oregon robin) 40, 51, 83–85, 223
song 40, 223
Thuja plicata 247, 272
Thunder Bay 124
Tideland spruce. See *Sitka spruce*
Timberline 240, 247, 252, 253
altitude 241, 242, 253, 272
variation 248
tree at White Pass 240, 246
in Sierra and Cascade Range 252
Timmerman, L. F. xxxv
Titlark 47, 59, 93, 210, 211, 214
Tlinkit 195
camps 152
massacre at Sitka 195
Toad 115
Todd, Capt. C. C. 310
Tongass Narrows 116
Topeks 99, 171
Totem poles 116–117, 146–148, 150
Townsend bunting 107
sparrow 209, 214, 217, 219, 224
Traders 188
Trading privileges 192
posts, fortified 196
Treadwell mine 29–30, 275
Treeless country 77, 87, 236, 244
Trees in proximity to glaciers 52–53, 130, 251–252
diameters 240, 241, 252
Trelease, Prof. Wm. xxxiv, xxxvi, 18
Trout stream 23, 82
Trudeau, Dr. E. L. xxxv
Tundras 68–69, 105–107, 234, 265, 267
Tuolumne River, Calif. 119
Turner Glacier 55–56, 60, 123, 131
Turtle doves 7
Tyonek saltery 350

Uyak Bay 78–79
Ugak Island fox farm 360
Umiaks 178–181
Umnak Island 291, 292, 312
Unalaska 90–94, 168, 196
spruces introduced 245
temperature and rainfall 268
Unimak Island 90
Upper Yukon 34
Utah, Bad Lands 5, 6
Vaccinium 249, 250
Varied Thrush—see *Oregon Robin*
Vancouver, George 130, 190, 191–192, 262
Island 19, 20, 22
Vassar Glacier 69, 127
Verdure 79, 82, 83, 114, 133
Veniaminof 196–198, 295, 332
Viburnum pauciflorum 249, 250
Victoria 19, 129

Violets 61, 222
Virgin Bay 68, 69, 74
Volcanic peaks—
Edgecumbe 50, 190
Iliamna 76
Isanotski 90
Pavlof 88
Redoubt 76
Shishaldin 90
Volcanic shower 305–306
Volcano, newest (Bogoslof) 291–336
Volcanoes, chain 133–134, 264

Wagtail, Siberian yellow 230
Walrus Island 99
hides 101
Warbler, lutescent 28, 40, 217
pileolated 206, 217, 222, 223
summer or yellow 19, 61, 213, 217, 222, 224, 225
War canoes 141
Washburn, M. L., xxiii, xxxv
article on fox farming 357–365
Water Ouzel 51
Water-taking 104
'Weary Willie' 211
Weather in June 77
record 268
Wellesley Glacier 69, 127
Whale fishing 199
Whalers 104, 108, 178, 179, 199
Western Union Telegraph Co. 201, 203
Whaling fleet 103, 199
White cedar 141
White Pass, birds 33, 210, 211
Custom House 33
excursion 31–34
railroad terminus 33, 34
White River 266
Wingham Island 187
Willows 61, 225, 239, 249, 250, 252
Wind flowers 222
Winter Wren 24
Wood Island 224, 245
Woodpecker, Harris 206
Red-throated 28
Wrangell 148, 208, 209, 210, 260
population 273
Wrangell Land 199
Narrows 28
Wren, Winter 85, 218, 224
Wyoming plains 4

Yakutat Bay 52–61, 247, 260–261
birds 61, 216–219
glaciers 59, 122, 131
sealing village 60, 158–165
strawberries 115, 218
Yale Glacier 69, 126
Yellow poppy 98, 102, 227, 231
Yemans, Dr. H. W. 307, 322, 336
Yosemite Valley 125
Yukon and White Pass Railroad 31
Yukon River 198–199, 201, 235, 258, 266–267

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